

[54] INDENTED SHEET

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[52] U.S. Cl. 24/213 B; 24/214; 24/217; 428/33; 428/99; 428/141; 264/299

[51] Int. Cl. B32b 3/30

[58] Field of Search 161/116, 123, 131, 133, 161/119, 120, 125, 130, 127; 52/519; 264/241, 299

[56]

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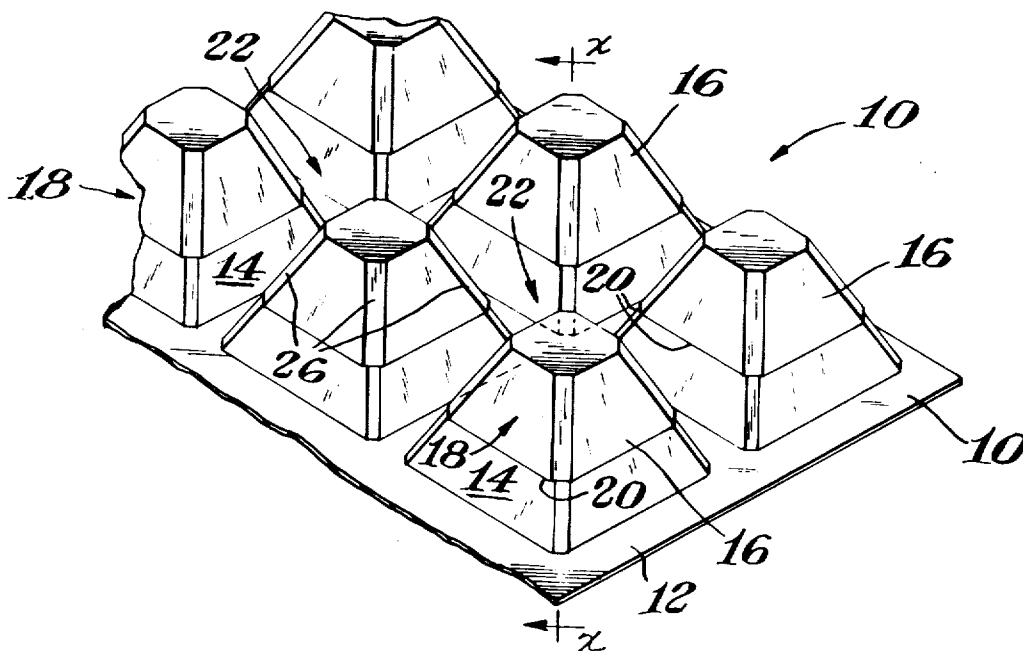
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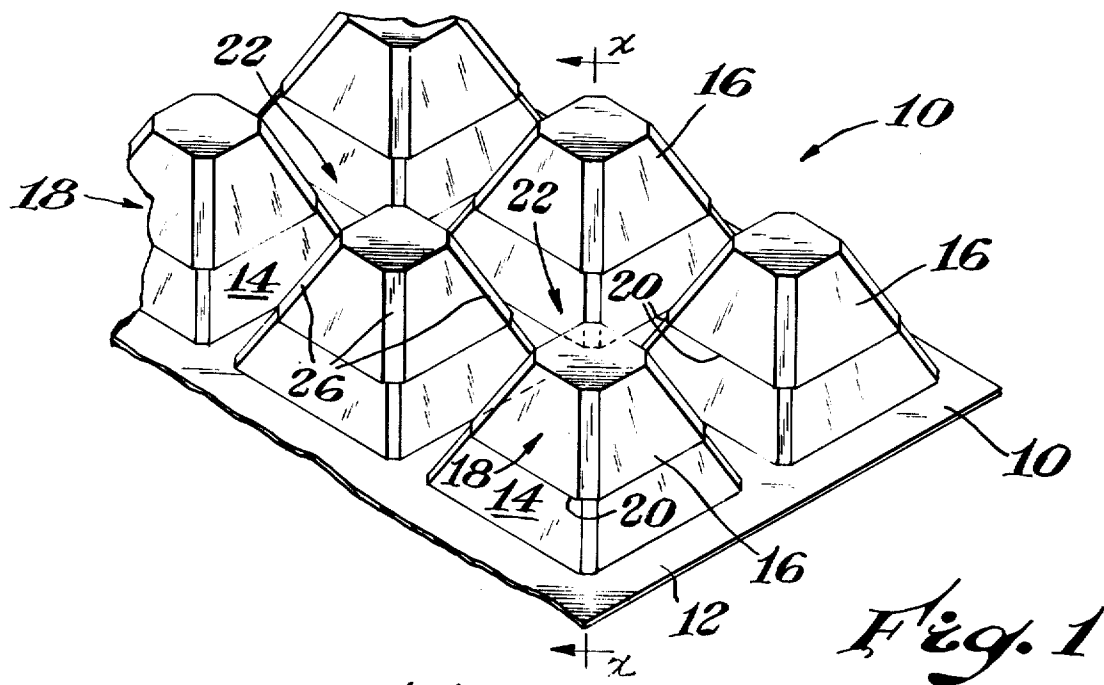
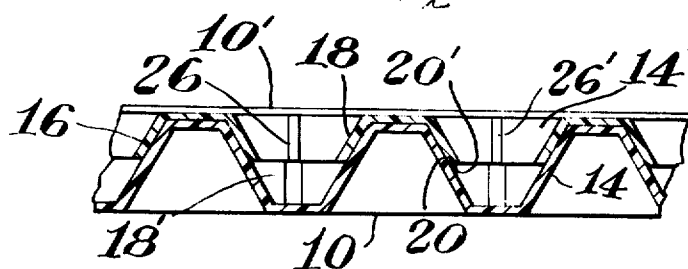
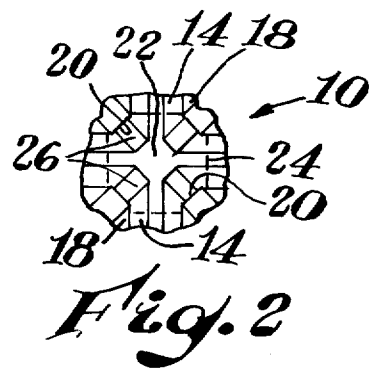
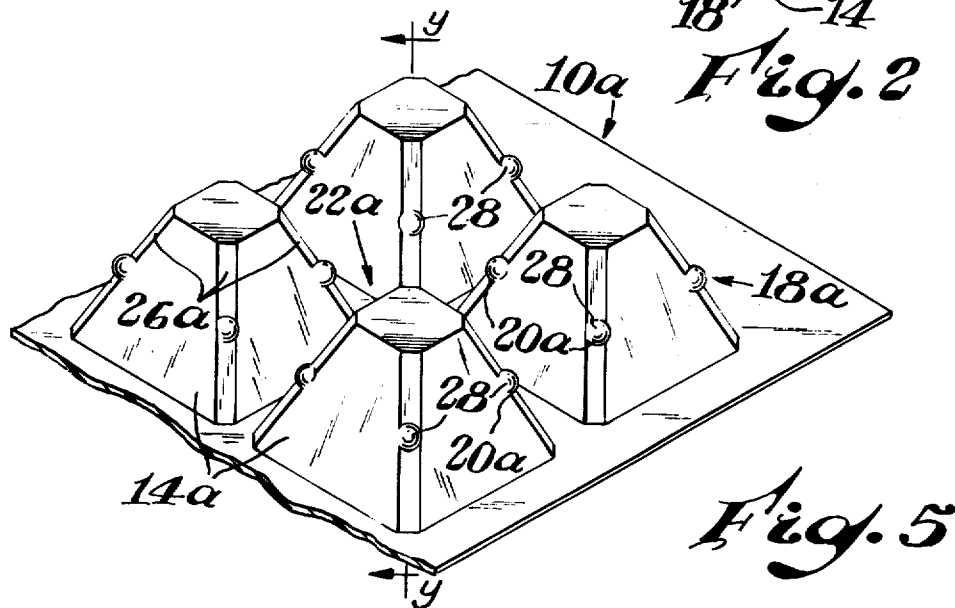
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ABSTRACT

Indented sheet structure is disclosed which describes a surface of repeating hollow projections, and repeating pocket areas or valleys, at least certain of the pocket areas having a restricted neck opening defined by the side profile(s) of projection(s) in adjacent positioning thereto. Like sheets are interdigitatable, in which posture, the projections snap fit into the restricted pocket areas of the opposite sheet, to mechanically interlock the sheets at a multiplicity of distributed points.

7 Claims, 8 Drawing Figures





SHEET 2 OF 2

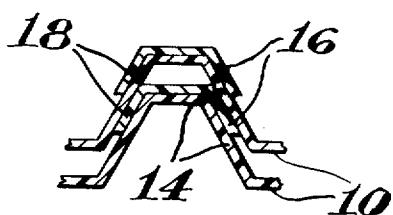


Fig. 4

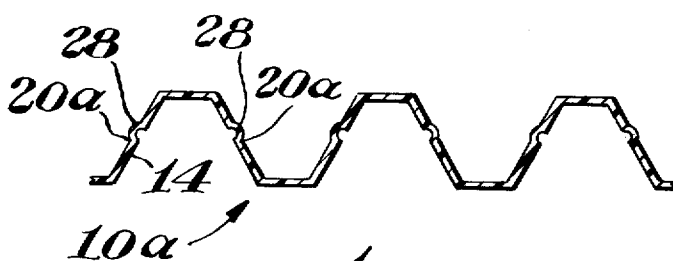


Fig. 6

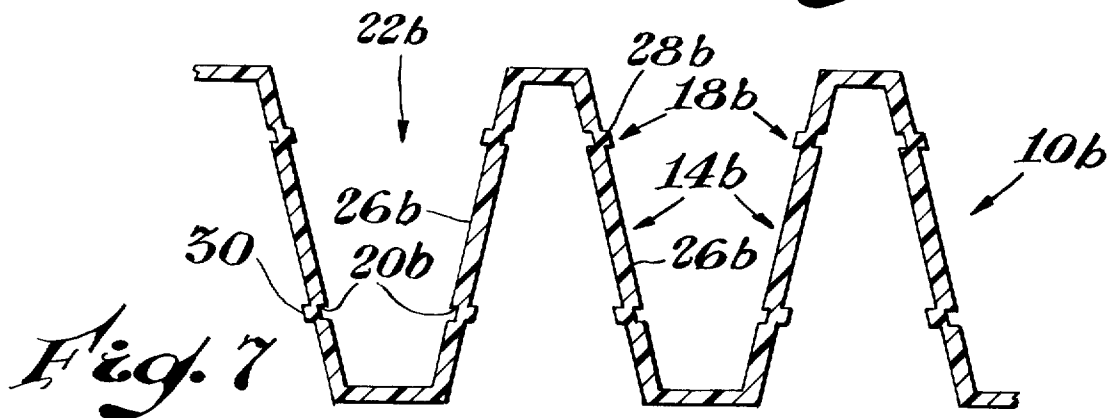


Fig. 7

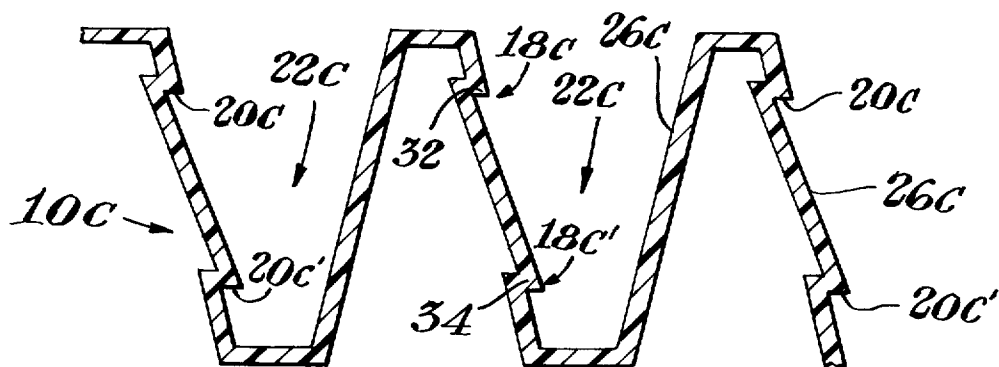


Fig. 8

INDENTED SHEET

The primary objective of this invention is to provide indented sheet structure describing a surface which is mechanically interlockable with a like surface.

The present invention more specifically contemplates an indented sheet describing over at least part of a major surface thereof, repeating hollow projections, and repeating pocket areas or valleys, the outline of the latter being preferably of generally inverted sizing and configuration to the projections. At least certain of the projections include offset profiles such as in the form of an enlarged head or head portion, which collectively or individually define restricted neck openings in the hollows of adjacent pocket areas. When interdigitated with a like surface, the sheets mechanically interlock or tie together through forcible entry of the projections into the restricted pocket areas of the like sheet.

Further features and advantages of the invention will be more apparent in and by the following more detailed description and specification hereof, taken in connection with the accompanying drawings wherein:

FIG. 1 is an isometric view illustrating a section of indented sheet made according to the general teachings and principles of this invention;

FIG. 2 is a fragmentary top view isolating one of the many identical pocket areas of the indented sheet of FIG. 1, and shows by imaginery dotted line representation, the restricted neck opening of the isolated pocket area.

FIG. 3 is a cross sectional view of the indented sheet of FIG. 1 as it would appear if viewed along reference line X—X, and additionally shows a like indented sheet in mechanically interlocked assembly with the FIG. 1 sheet;

FIG. 4 is a view like FIG. 3, only with the like sheets being nested by reversely facing the sheets, for compactness in storing and porting plural units thereof;

FIG. 5 is a view like FIG. 1, only showing a modified form of the invention;

FIG. 6 is a cross sectional view through FIG. 5, taken along reference line Y—Y thereof; and

FIGS. 7 and 8 are views like FIG. 6, respectively, only showing still further modified forms of the invention.

Referring now to the drawing, FIG. 1 illustrates a section of indented sheet 10 describing over a major surface portion 12 thereof, spaced apart, hollow projections 14 of pyramidal shape and which repeat in a rectangular pattern. Each projection is capped by an element 16 of miniature pyramidal shape, which is positioned symmetrically over the upper tip or apex thereof, and which extends downwardly, and terminates approximately at the mid-height of the projection.

Cap elements 16 may be attached by gluing, heat sealing, riveting, or the like, or may be integrally formed in molding the sheet. The cap elements define a species of what is referred to herein as an enlarged head or head portion 18 associated with each or at least certain of the projections 14. The underside of each head portion defines a circumferentially continuous offset profile 20, in the otherwise generally uniformly tapered sidewall of each projection.

Sheet 10 further defines numerous spaced apart pocket areas or valleys 22 of substantially inverted configuration and sizing to projections 14, and which repeat in a like rectangular pattern to that of the projections. The offset profiles 20 of projections 14 collec-

tively define a restricted neck opening or passage 24, located at approximately mid-depth in each pocket area. The imaginery outline of one such restricted neck opening 24 is described by dotted lines in FIG. 2 to assist visualization thereof.

Referring now to FIG. 3 the same illustrates a pair of identical sheets 10 and 10' placed in interdigitated positioning with respect to the other, that is, with the projections 14 of the sheet 10 intimately cradled in the inverted pyramidal shaped pocket areas of sheet 10'. To obtain this position, sheets 10 and 10' are firmly pressed together, thereby resiliently forcing the enlarged head portions 18 of the projections past the restricted neck openings 24 of the opposite sheet. Each projection, at least in the central area of sheet 10, is thus forcibly slipped between a quadrant of projections on the opposite sheet 10', and vice versa, whereby profiles 20 abut in the horizontal plane, forming a fastening point at each corner 26 of the respective projections. The like sheets 10 and 10' are thus expediently locked together at numerous generally regularly distributed points, thereby avoiding entirely the need for, or only having supplemental need for extraneous rivets, staples, adhesives, and the like, to fasten or tie together the indented sheet structure of this invention.

Referring now to FIG. 4, sheets constructed under these teachings may be nested, for compactness, in storage and porting. To this end projections 14 are tapered in a manner to fit and nest into the hollow undersides of the projections defined in a succeeding sheet in a nested or stacked arrangement thereof. Employing a solid cap element 16 makes it virtually impossible for the sheets to bind together when nested. A greater outside as opposed to the inside diameter of the projections can also be designed into the sheet structure to discourage binding between nested sheets such as, for example, if the sheets are to be constructed employing a hollow enlarged head portion of the types shown in subsequent embodiments hereof.

Referring specifically to the embodiment of FIGS. 5 and 6, a selectively placed hollow knob 28 is located at each corner 26a of the pyramidal shaped projections 14a of the modified sheet 10a shown here. The knobs collectively define a pocket area 22a of generally the same outline as that shown in FIGS. 1 and 2, wherein the projections surrounding each such pocket area 22a describe a restricted neck opening therein of similar character to pocket areas 22 above. A distinction, however, is that the offset profile 20a of each projection 14a is discontinuous in form, rather than circumferentially continuous about the projection. Functionally, sheet 10a will interlock with an identical sheet, or any generally like sheet such as sheet 10 supra, provided the proportions are correct between the two sheets sought to be interlocked.

The invention is further illustrated by way of the FIG. 7 embodiment which depicts an offset profile 20b displaced downwardly from the mid-level height of pyramidal shaped projections 14b. The profile 20b is formed by indenting the side wall of projections 14b as at 30 near the base of each projection. The profile 20b may be continuous, by means of a circumferentially continuous indentation, or discontinuous by means of a localized indentation at each or certain of the corners 26b of projections 14b. Using the condition of four local indentations associated with each projection, the head portion 18b can comprise a local knob 28b selec-

tively disposed at each of the four corners 26b of projections 14b, respectively. Each such knob is in linear alignment with, but spaced upwardly from an indentation 30 at each such corner position. For reasons as will be evident, the spacing of the knobs from the top of projection 14b, corresponds to the spacing of the indentations from the base of the projections. In the interlocked position between interdigitated sheets 10b (not shown), knobs 28b are caused to snap into the indentations 30, respectively, resulting in a mechanical interlocking of the surfaces.

By way of yet still another illustration of the invention, in FIG. 8 the projections 14c of sheet 10c demonstrate the use of a double enlarged head portion associated with projections 14c, such double head portion being indicated by 18c and 18c'. Assuming again truncated pyramidal shaped projections set in rectangular pattern, the head portions may comprise a double interruption or undercut ledge structure 32 and 34 formed locally at corner(s) 26c of each projection 14c. Such double interruption, in turn, provides a double offset profile structure 20c and 20c', and corresponding a double restricted neck opening in the pocket areas 22c of the sheet. In the interdigitated position of sheet 10c with a like surface (not shown), it will be apparent that the head portions 18c and 18c' provide a double strata or double level mechanical fastening formation with the pocket areas of a like or generally like surface, and vice versa.

Referring now to some of the generalities of this invention, projections of the characteristic type intended herein may be formed to have any practical and desired shape, so long as the same include an offset profile capable of defining an appropriately sized, restricted neck opening in a sufficient number of the pocket areas, to provide a surface structure firmly attachable by interlocking to a like surface, or the equivalent thereof. As illustrative examples, therefore, the invention may be practiced utilizing generally spherical or hemispherical projections, saddle-shaped generating areas as shown in U.S. Pat. No. 3,227,598, triangular and various other polygonal shapes which may be truncated or otherwise, provided such projections are modified in structure according to the teachings hereof. The projections intended hereby may be of uniform height or tapered. Moreover, while it is oftentimes desirable to have one side of the sheet flat, such as the underside of sheet 10 illustrated in FIG. 1, it is understood that the present invention can be practiced employing sheets having raised areas on both sides thereof, by modifying at least one side of such sheet in accordance with these teachings. Also, while the invention has been described particularly whereby the pattern is rectangular in nature, that is, each quadrant of projections collectively defines or surrounds a pocket, and vice versa, numerous other patterns may be employed so long as the

teachings herein are observed.

Preferred materials for constructing the sheet structure hereof includes synthetic resinous thermoplastics such as, for example, vinyl chloride, styrene, ethylene, propylene, and various like materials as homopolymers or copolymers. Particularly impact polystyrene would be an excellent material for use herein. The sheets if formed from formable plastic sheet materials such as the above or other polymeric sheet materials, can be fabricated by heat and/or pressure forming techniques.

While certain representative embodiments and details have been shown for the purpose of illustrating the invention, it will be apparent to those skilled in the art that various changes and modifications can be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. An indented sheet describing at a surface portion thereof, repeating, regularly distributed, hollow projections, a like distribution of repeating pocket areas, at least certain of such projections including enlarged head portions, respectively, restricted neck regions defined in said pocket areas through means of said enlarged head portions, said enlarged head portions comprising cap elements affixed to said projections, such indented sheet being comprised of sufficiently resilient material for deformable, resilient passage of such enlarged head portions by a like-sized restricted neck region for purpose of interlocking such surface portion to a like surface or the equivalent thereof.

2. The indented sheet of claim 1 wherein said pocket areas are of generally inverted configuration and size to the projections.

3. The indented sheet of claim 2 wherein said projections taper away from the plane of the sheet.

4. An indented sheet structure describing along a surface portion thereof the combination comprising a multi-linear pattern of hollow projections, a like pattern of repeating pocket areas, such patterns being out of phase so that said surface portion is interdigitable with a like surface, at least certain of said projections having cap elements affixed thereto and defining restricted neck regions in said pocket areas, said indented sheet being comprised of sufficiently resilient material for deformable, resilient passage of such cap elements by a like-sized restricted neck region for purpose of interlocking such surface portion with a like surface or the equivalent thereof.

5. The indented sheet of claim 4 wherein said projections taper away from the plane of the sheet.

6. The indented sheet of claim 5 wherein said pocket areas are of generally inverted size and configuration to said projections.

7. The indented sheet of claim 6 wherein said projections are generally pyramidal in shape.

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UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 3,899,805
DATED : August 19, 1975
INVENTOR(S) : William J. McMillan

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

Column 4, line 24, delete "heat", first and second instance, and insert --head-- therefore.

Column 4, line 28, delete "heat" and insert --head--.

Signed and Sealed this
twenty-seventh **Day of** *January* 1976

[SEAL]

Attest:

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Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks