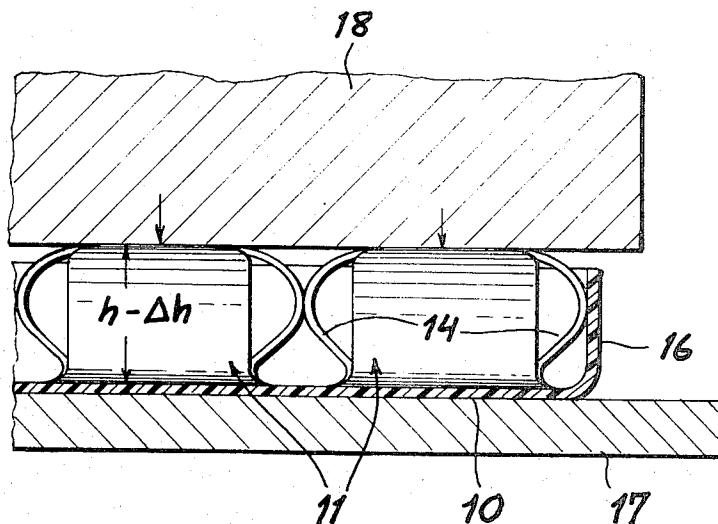


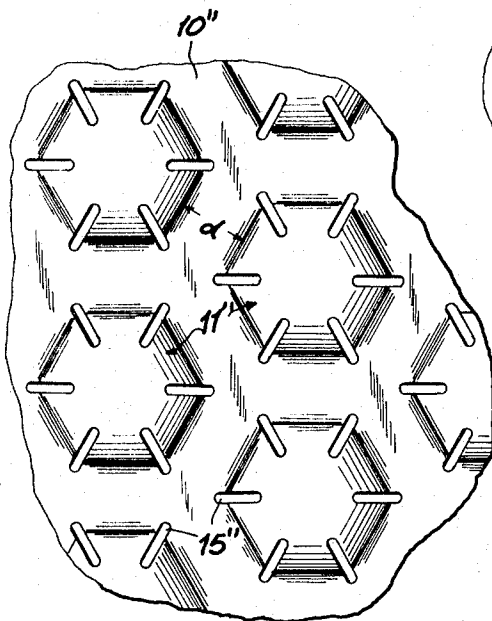
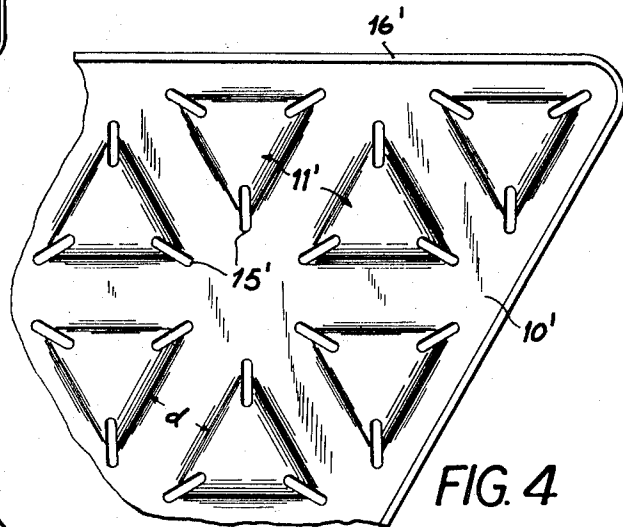
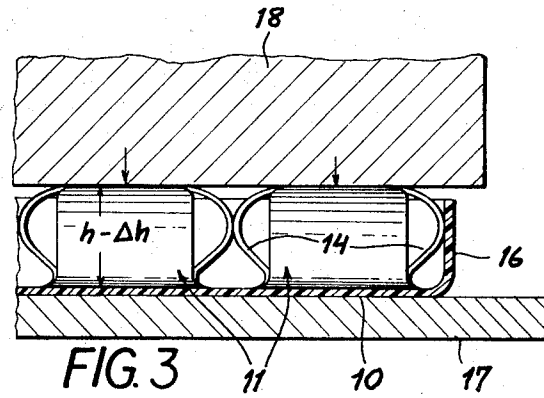
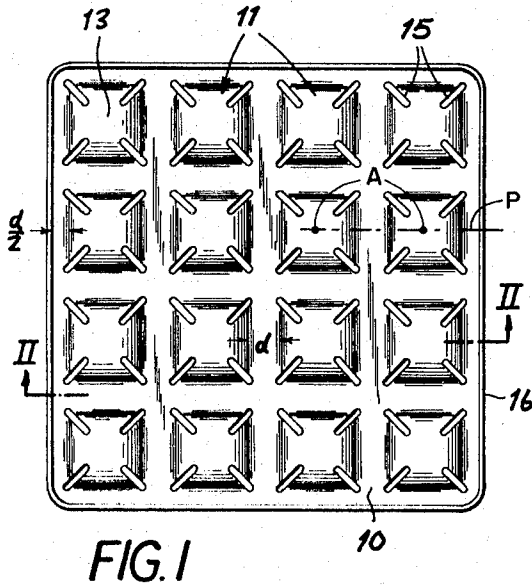
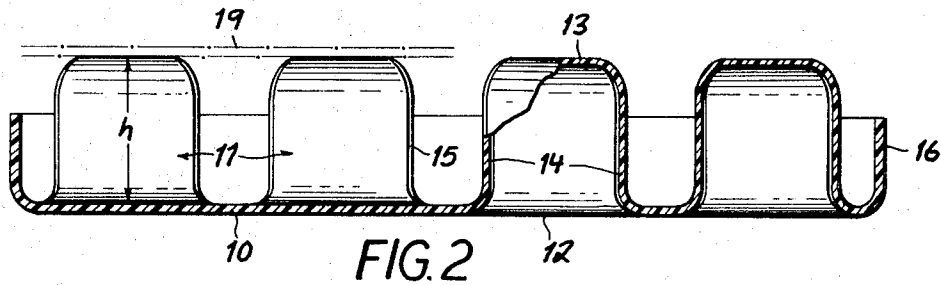
[54] **RESILIENT SUPPORT**[76] Inventor: **Rudi Bass**, 98 Riverside Drive,
New York, N.Y.[22] Filed: **May 10, 1971**[21] Appl. No.: **141,738**[52] U.S. Cl.**248/350**, 161/110, 161/131[51] Int. Cl.**A47g 29/00**[58] Field of Search248/350, 22, 358 AA,
248/346; 161/127, 130, 131, 110; 267/153[56] **References Cited****UNITED STATES PATENTS**

3,008,702	11/1961	Breneman	267/153
2,052,665	9/1936	Clark et al.	161/127
2,408,856	10/1946	Hussman	248/22
2,920,884	1/1960	Rowland et al.	248/22

Primary Examiner—Edward C. Allen*Attorney*—Karl F. Ross[57] **ABSTRACT**

A base of resilient (polymeric or metallic) sheet material carries a multiplicity of cup-shaped projections of polygonal outline formed in one piece therewith, each projection having a generally prismatic shape with slits along their longitudinal edges enabling individual deformation of its several sides under pressure acting upon the bottom of the cup. The coplanar cup bottoms may support a load parallel to the base or may collectively act as a bumper or shock absorber. The mutual separation of the undeformed projections is substantially less than their height so that, in response to a predetermined loading stress, their outwardly bulging sides contact one another and prevent further depression of the cup bottoms toward the base.

9 Claims, 5 Drawing Figures



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RESILIENT SUPPORT

My present invention relates to a structural unit adapted to serve as a resilient support for a load, as a shock absorber, as a reinforcing insert between layers of paneling, or as any other type of component designed to sustain loading stresses distributed over a broad area.

The general object of my invention is to provide a light-weight unit of this character which can be mass-produced from a variety of resilient sheet materials, such as elastomers or metals, by integral molding or stamping and which can therefore be manufactured in an inexpensive manner.

A more specific object is to provide a unit of this description which will readily yield to loading pressures up to a predetermined level and, upon attainment of such level, will perceptibly stiffen to resist further deformation.

It is also an object of my invention to provide an essentially flat load-supporting unit of the type referred to which can be conveniently stacked with any number of similar units to increase the cushioning effect.

These objects are realized, in conformity with my present invention, by the provision of a base having a multiplicity of bumper elements of resilient sheet material rising therefrom, each of these elements including a central portion held spaced from the base by a plurality of spider legs integral therewith; the spider legs are outwardly deformable under a load pressure acting upon the central portion in the direction of the base, such load pressure being about evenly distributed over the several bumper elements by virtue of the fact that the central portions thereof lie (in the undeformed state of their legs) substantially in a plane parallel to the base.

According to a more specific feature of the invention, the spacing of neighboring elements is shorter than the height of their spider legs whereby confronting legs of such neighboring elements, upon bulging outwardly under load, contact each other in response to a predetermined minimum load pressure so as effectively to resist further deformation.

Advantageously, the central portions of the bumper elements are of generally polygonal (triangular, rectangular, square or hexagonal) configuration, with a spider leg extending from each side of the polygon. For maximum support, the legs of each element should closely adjoin one another so as to form part of a generally cup-shaped structure whose concave side faces the base, the central portion of the element constituting the cup bottom.

Although, in principle, the several bumper elements could be manufactured independently of the base and secured thereto by welding, riveting or the like, it is more expeditious to make them unitary with that base by one of the processes referred to above. In such a case the base has a multiplicity of generally polygonal cutouts which are overlain by respective bumper elements whose spider legs merge into the edges of the cutouts, preferably with a slight curvature so that the legs are faired into the base. The major part of each leg may be substantially straight and perpendicular to the base, for greater structural rigidity, whereby each element has a substantially prismatic structure.

In the case of a four-sided prism, the several bumper elements are advantageously arrayed in orthogonally intersecting rows and files; with a cup bottom in the shape of an equilateral or isosceles triangle, the rows and files will intersect at acute angles, e.g. of 60°. With a hexagonal outline the elements may be arrayed in honeycomb fashion.

In all instances, the base is advantageously provided with an upstanding frame which is preferably integral therewith and whose spacing from the outermost bumper elements is substantially half the mutual distance of these elements, this frame being therefore engaged by the bulging outer legs of the outermost elements under a load pressure sufficient to let the confronting legs of neighboring elements contact each other as described above. With such a frame, which need not rise to more than about half the height of the bumper elements, the structure is further stiffened against load pressures exceeding the predetermined threshold.

The above and other features of my invention will be described in detail hereinafter with reference to the accompanying drawing in which:

FIG. 1 is a plan view of a load-supporting unit according to the invention;

FIG. 2 is a cross-sectional view of the unit in FIG. 1, taken on the line II — II thereof but drawn to a larger scale;

FIG. 3 is a fragmentary cross-sectional view similar to part of FIG. 2 but showing the unit in a deformed state; and

FIGS. 4 and 5 are fragmentary plan views of two alternate arrays.

The load-supporting unit shown in FIGS. 1 — 3 comprises a base 10 of elastomeric sheet material integrally molded with a multiplicity of generally prismatic bumper elements 11 of inverted cup shape which form an array of orthogonally intersecting rows and files. Elements 11 register with rectangular cutouts 12 in base 10 and consist each of a square central portion 13, constituting the bottom of the cup, whose sides are joined to respective spider legs 14 of generally elongate S-shape (as viewed in an axial plane) separated by narrow gaps 15 extending along the four longitudinal edges of the prism. If the unit is produced by stamping (e.g. from sheet metal) rather than by molding, the gaps 15 may be formed as diagonal cuts before or during the deep-drawing of the cups. Confronting legs 14 of adjoining elements are deformable in a common plane P (FIG. 1) which bisects them and includes the axes A of these two elements.

In the undeformed position of the bumper elements 11, as shown in FIGS. 1 and 2, these elements are equispaced and separated by a uniform distance d which is a small fraction of their height h . A frame 16, integrally rising from base 10 to slightly more than half that height h , is spaced by a distance $d/2$ from the outermost elements of the array.

When the unit is placed under stress, e.g. on being squeezed between a foundation 17 and a load 18 as illustrated in FIG. 3, the legs 14 of the several elements 11 bulge outwardly and, at first, elastically absorb the load pressure. If this load pressure exceeds a certain minimum level, confronting legs 14 of adjoining units 11 contact each other while the exposed legs of the ou-

termost elements engage the substantially nonyielding frame 16 as shown in FIG. 3. In this position, the unit is virtually incompressible since further deformation is resisted by the compressive strength of the spider legs 14 rather than by their flexural strength.

If desired, one or more additional units of similar configuration may be interposed between the one illustrated in FIG. 3 and either the foundation 17 or the load 18, thereby forming a stack of increased strength capable of elastic deformation over a stroke length equal to $n\Delta h$ where n is the number of stacked units and Δh is the extent of compression from the position of FIG. 2 to that of FIG. 3.

The cup bottoms 13 of bumper elements 11 could be fixedly interconnected by being soldered or otherwise secured to an overlying sheet, plate or set of strips, as schematically illustrated at 19 in FIG. 2.

FIG. 4 shows an alternate unit with base 10' and bumper elements 11' of equilaterally triangular outline, the gaps 15' being located at the corners of each triangle. Elements 11' are arrayed in rows and files intersecting at an angle of 60°, parallel to the sides of the base 10' which is bounded by a frame 16' and which may have a triangular or parallelogrammatic contour.

In FIG. 5 I have shown the base 10'' of still another modification in which the elements 11'' are of hexagonal outline and disposed in a honeycomb array. As in the preceding embodiments, the spider legs of each element are separated by narrow slits 15'' at the corners of the polygon and are normally separated from confronting legs of neighboring elements by the aforementioned distance d .

Although the drawing specifically illustrates the use of my resiliently deformable unit as a load support, it will be apparent that the same can also be utilized for other purposes, e.g. as part of a bumper for automotive vehicles and the like.

I claim:

1. A resilient pressure-absorbing unit comprising a base and a multiplicity of bumper elements of resilient sheet material rising from said base, each of said elements having a central portion spaced from said base

and a plurality of spider legs integral with said central portion anchored to said base, said spider legs being arrayed about an axis and being outwardly deformable in different axial planes under a load pressure acting upon said central portion in the direction of said base, the central portions of all said elements normally lying substantially in a common plane parallel to said base, said elements being substantially equispaced by a distance shorter than the height of said spider legs, the legs of neighboring elements being bisected by a common axial plane and spaced apart in the unloaded condition for mutual contact upon outward deformation thereof in response to a predetermined minimum load pressure.

2. A unit as defined in claim 1 wherein said central portions have a generally polygonal outline, with a spider leg extending from each side of the polygon.

3. A unit as defined in claim 2 wherein the legs of each element are closely spaced, thereby forming a generally cup-shaped structure with a concave side facing said base, said central portions constituting the bottoms of the cups.

4. A unit as defined in claim 3 wherein said structure is substantially prismatic in the undeformed state of its legs.

5. A unit as defined in claim 3 wherein said central portions are squares, said elements forming orthogonally intersecting rows and files.

6. A unit as defined in claim 3 wherein said elements are unitary with said base, the latter having generally polygonal cutouts with edges merging into the spider legs of associated structures spanning said cutouts.

7. A unit as defined in claim 6 wherein said spider legs are faired into said base.

8. A unit as defined in claim 1 wherein said base is provided with an upstanding frame spaced from the outermost elements by substantially half said distance for engagement thereby upon deformation of their legs under said minimum load pressure.

9. A unit as defined in claim 8 wherein said frame rises to substantially half the height of said elements.

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