Jan. 3, 1967 H. J. DONALD 3,295,840

TOWER PACKING

Filed June 27, 1962 2 Sheets-Sheet 1

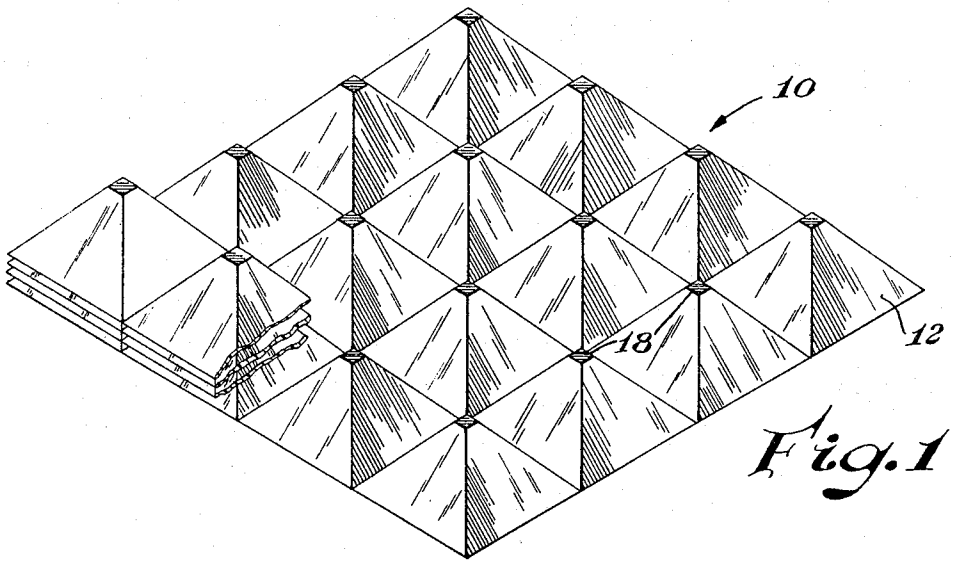


Fig. 1

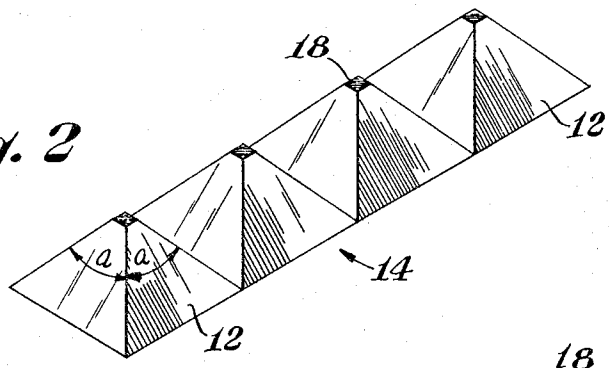


Fig. 2

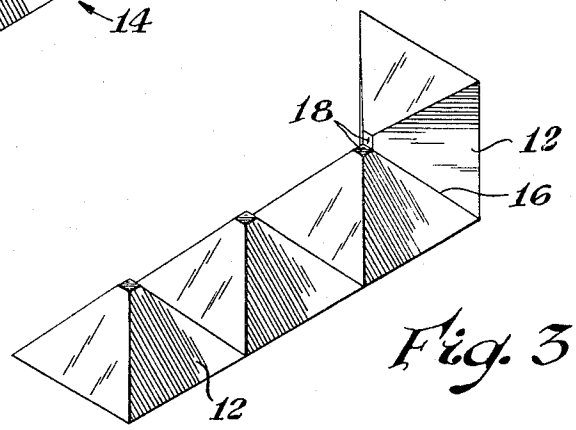


Fig. 3

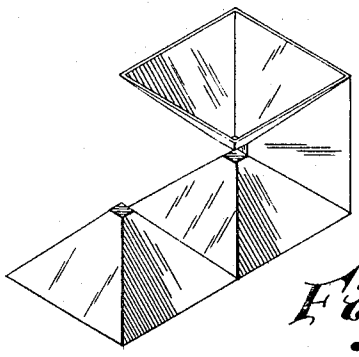


Fig. 4

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TOWER PACKING

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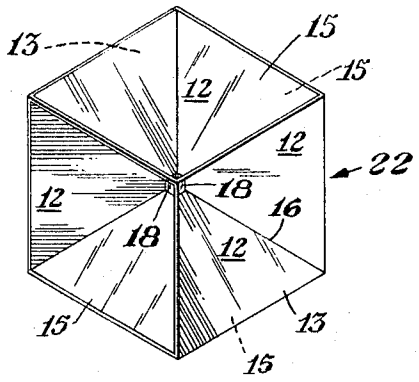


Fig. 5

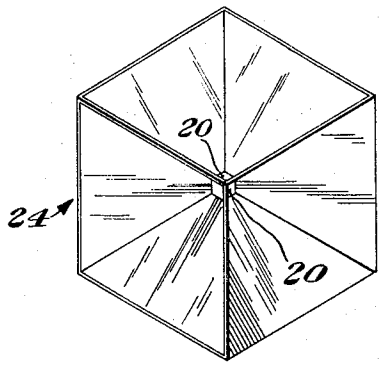


Fig. 6

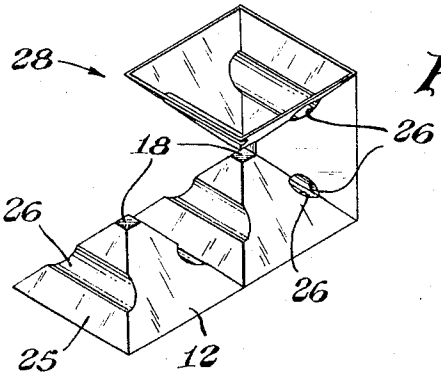


Fig. 7

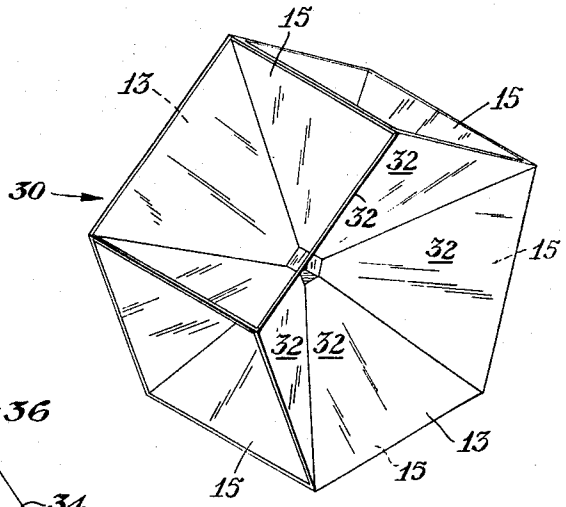


Fig. 8

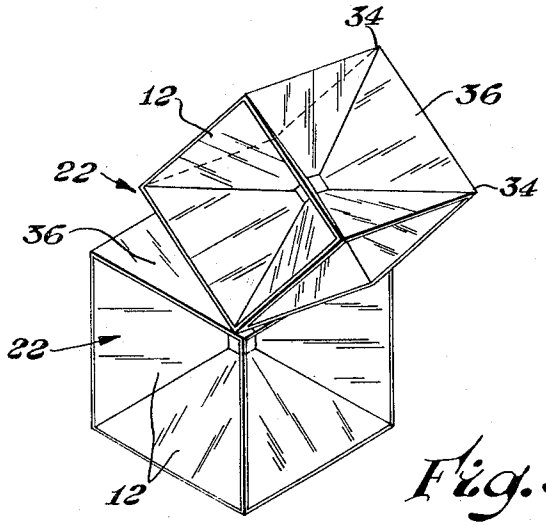


Fig. 9

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TOWER PACKING

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1 Claim. (Cl. 261—95)

The present invention relates generally to an improved tower packing and a process for its formation and, more particularly, relates to a novel tower packing which can be formed from relatively flat plastic sheets shipable in that condition prior to final assembly by the ultimate user.

Tower packing bodies with widely differing geometric shapes have been proposed and used for filling gas/liquid washing or scrubbing towers and for vapor/liquid contact towers such as filled distillation towers, as well as for liquid/liquid extraction towers. To be efficient in providing the desired contact, the packing bodies must expose a maximum surface area to the fluids, and they must provide a large void volume in the filled tower to minimize the resistance to flow or back pressure. Among the more widely used filling bodies for gas/liquid towers, for example, have been Raschig rings and Berl saddles. Other packing bodies have sometimes been of a generally orbicular or proximo-spheroidal configuration. Such packing bodies are generally placed randomly in a tower. It is most advantageous if the packing bodies do not nest in one another so as to avoid reducing the available surface for fluid contact and avoid hindrance of gas flow.

Because of the above prerequisites of tower packings, they are generally of relatively odd configurations which are not only relatively expensive to produce but, because of their large surface and void areas, their non-nesting characteristics, and their requirement of light weight, are relatively awkward and expensive to package for shipping. Prior to this invention, it has not been possible to produce a packing of adequate configuration directly from an extruded sheet-forming operation.

Accordingly, an object of the present invention is to provide a novel and improved tower packing.

Another object of the present invention is to provide a novel and improved tower packing which is readily formable by the ultimate user from a sheet of material.

Still another object of the present invention is to provide a novel and improved tower packing which is relatively inexpensive to make, package and ship, and which provides a large effective contact area with fluids while avoiding nesting in a tower.

Still another object of the present invention is to provide an improved method for preparing tower packings from an extruded plastic sheet.

A still further object of the present invention is to provide for tower packings of a plurality of different designs formed from extruded plastic sheets.

Briefly then, the present invention provides a method for preparing an improved tower packing, the method comprising forming of a plastic sheet into a linear configuration of pyramidal structures which, when folded upon themselves by the ultimate user, form a packing, the end walls and peripheral side wall of which are pyramidally recessed. The resulting packing provides a novel design exhibiting characteristics considered favorable in such applications.

Yet additional objects and advantages of the present invention, and its numerous cognate benefits and features are even more apparent and manifest in and by the ensuing description and specification taken in conjunction with the accompanying drawings in which, wheresoever possible, like characters of reference designate corresponding material and parts throughout the several views thereof, and in which:

FIGURE 1 is an isometric view of a plastic sheet illustrating a step of the present invention;

FIGURE 2 is an isometric view of a strip from the sheet of FIGURE 1, thus illustrating a subsequent step of the invention;

FIGURE 3 is an isometric view of the strip of FIGURE 2 showing another step of forming a novel packing;

FIGURE 4 is an isometric view of the strip of FIGURE 2 illustrating yet another subsequent step of forming a novel packing;

FIGURE 5 is an isometric view of a completed packing formed according to the principles of the present invention;

FIGURE 6 is an isometric view of a modified form of tower packing constructed according to the principles of the present invention;

FIGURE 7 is an isometric view of yet another modified form of tower packing constructed according to the principles of the present invention;

FIGURE 8 is an isometric view of still another modified form of tower packing constructed according to the principles of the present invention; and

FIGURE 9 is an enlarged isometric view of a pair of packings of FIGURE 5 in an engaged relation.

It is obvious that it is desirable to produce a tower packing which is formable directly from a plastic sheet by the ultimate user. It has been found that by vacuum or pressure forming an extruded or otherwise formed plastic sheet **10**, as shown in FIGURE 1, to linear configurations of pyramidal structures **12** that it is possible to provide for such packings. The shipment of stacks of formed sheets **10** can be handled relatively inexpensively for the bulking factor is generally better than 100 to 1 of that otherwise possible if the packing were shipped in a fully assembled condition. Furthermore, such sheets can be made of relatively inexpensive thermoplastic materials such as polystyrene, polyethylene, polypropylene, copolymers of any of these thermoplastic materials, or the like.

The particular configuration of a pyramidal structure **12** will depend on the particular design desired. For example, if it is desired to provide a six-sided packing (four peripheral sides or sections and two opposite end sides or sections defined thereby when viewed as a three-dimensional figure), as illustrated in FIGURE 5 to be discussed in more detail hereinafter, four pyramidal structures **12** should be folded upon themselves as illustrated in FIGURES 2 to 5. The pyramidal angle a of such a six-sided packing will equal to 360° divided by the number of units to be folded, or in this case, the pyramidal angle a will be 360° divided by four, or 90°. Accordingly, it can be seen that pyramidal angle $a=360°/n-2$, where n is the number of sides or sections of a particular packing. The number of pyramidal units to be folded then is represented by $n-2$. The pyramidal angle of a finished packing thus can be readily mathematically calculated, although it is understood that in practice it need only closely approximate the calculated figure. Thus, to form a six-sided packing, it can be seen that a strip **14** (FIGURE 2) of four pyramidal structures **12** having a pyramidal angle of 90° are cut from a sheet **10**, the latter as seen in FIGURE 1. It can then be seen that one of the end pyramidal structures **12** is then folded upon its adjacent pyramidal structure **12** so that their edges **16** generally engage one another and their apex surfaces **18** are in juxtaposition. Further snowball type folding, as illustrated in FIGURE 4, is continued until the packing is in its final folded condition as illustrated in FIGURE 5 and the opposite free ends are sealed together by any

well known plastic adhesive, such as an epoxy resin, or by heat sealing. In this instance the two pyramidally recessed sections **13** comprise opposite end walls and the remaining four pyramidally recessed sections **15** comprise a peripheral side wall.

Although it is not absolutely necessary that the apexes, where edges **16** meet, form flat surfaces **18**, it has been found that by so flattening them point breaking is eliminated and liquid accumulation or retention is substantially prevented. Furthermore, forming the apexes as flat surfaces is no problem when using vacuum forming techniques. To further aid in preventing liquid accumulation and retention, flat surfaces **18** can instead be stamped out to provide voids **20** in the packing **24** as illustrated in FIGURE 6. Although voids **20** can be cut out of a completely formed packing **22**, it is preferable to stamp out these voids either when the packing is still in the form of a sheet **10** or in the form of a strip **14** while the pyramidal structures **12** are in a relatively flat position.

As an alternative, instead of making the mating faces **25** of pyramidal structures **12** flat and engaging as discussed previously, they can instead at least partially include shaped concave ribs or surfaces **26** to provide increased strength where such is felt necessary. This substantially prevents complete flat surface contact between mating surfaces and besides increasing the strength of a packing, also presents a greater degree of exposed surface for contact with tower fluids. Such surfaces **26** are illustrated in packing **28** of FIGURE 7, having one pyramidal structure **12** opened to more clearly show these surfaces.

To illustrate another typical modification, FIGURE 8 presents a seven-sided packing **30** formed from five pyramidal structures **32** each having a pyramidal angle equivalent to approximately 72°. Thus the packing **30** includes opposite end wall sections **13** and five side wall sections **15** about its side wall periphery. In a like manner an eight-sided packing (not shown) can be formed from six pyramidal structures having a pyramidal angle of approximately 60°, a nine-sided packing (not shown) can be formed from seven pyramidal structures having a pyramidal angle of approximately 51°, etc. The only limitation as to this type of configuration is that it be one that will not readily nest with adjacent packings in a tower.

An enlarged showing of two adjacent packings **22** is illustrated in FIGURE 9 to show that no nesting occurs. The reason for the lack of nesting is that the corner

angles **34** of each packing **22** are three-sided and will not readily nest within a four sided cavity **36** formed by the juxtaposed pyramids **12** forming the packing. The same will be true generally with most others, as for example, a seven-sided packing **30** has a three-sided corner which again will not readily nest within a five sided cavity.

It is obvious that novel packings **22, 24, 28, 30** and the like, can be employed for other purposes than that herein discussed. For example, they can be used as relatively inexpensive ornaments for Christmas decorations and the like. This is particularly advantageous since the plastic films forming these items can be either formed from colored plastic beads or can be readily painted after their formation by techniques as simple as dipping. 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 other changes and modifications can be made therein without departing from the spirit and scope of the invention.

Accordingly, what is claimed as new is:

A tower packing comprising opposite end walls and a peripheral side wall, each said end wall comprising a section pyramidally recessed toward a common center, said side wall comprising a plurality of pyramidally recessed sections about its periphery, the surfaces of each section extending toward said common center and approaching a pyramidal apex at an angle generally equal to $360°/n-2$, where n is the total number of sections in said packing, said apexes being spaced from one another and at least partially cut-out.

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