

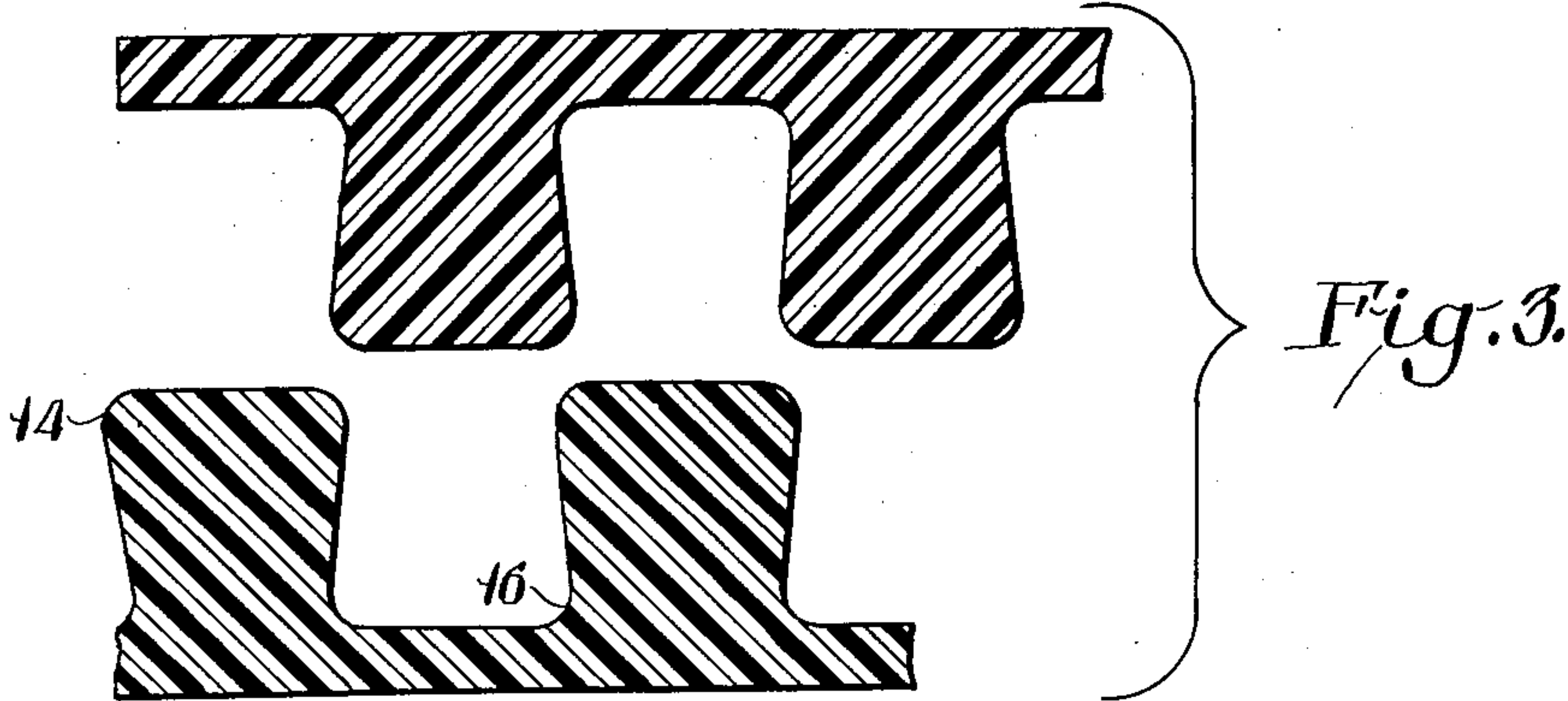
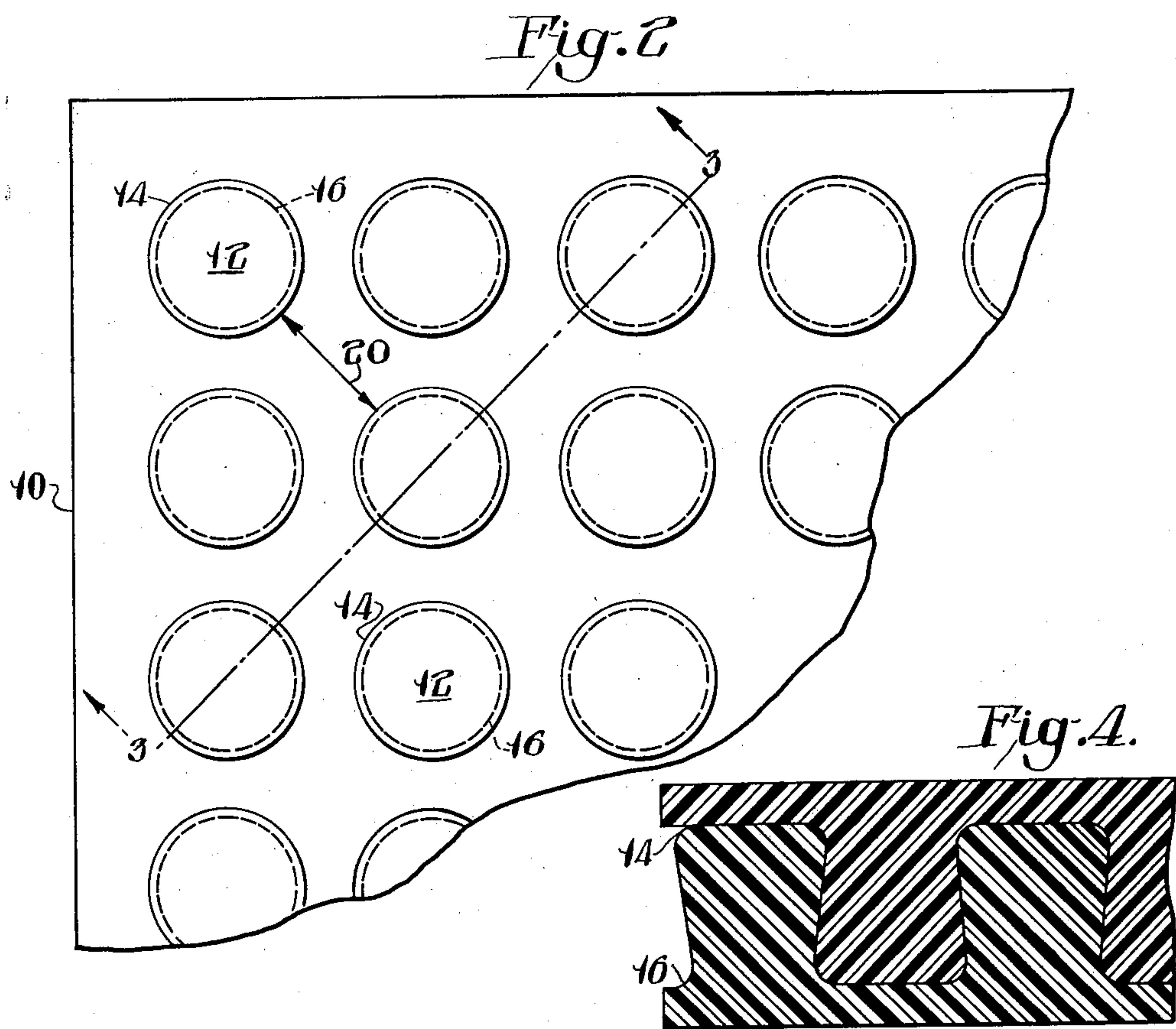
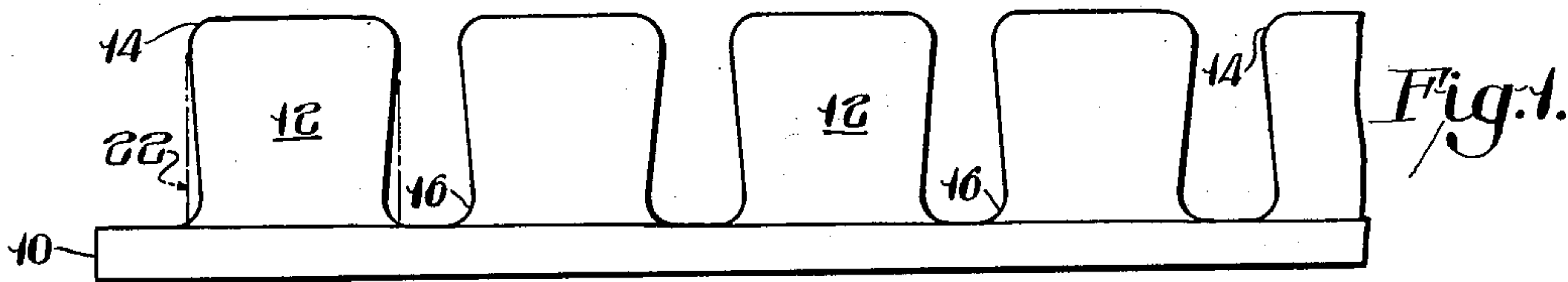
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M. FOX ETAL
FASTENER

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Fig. 5.

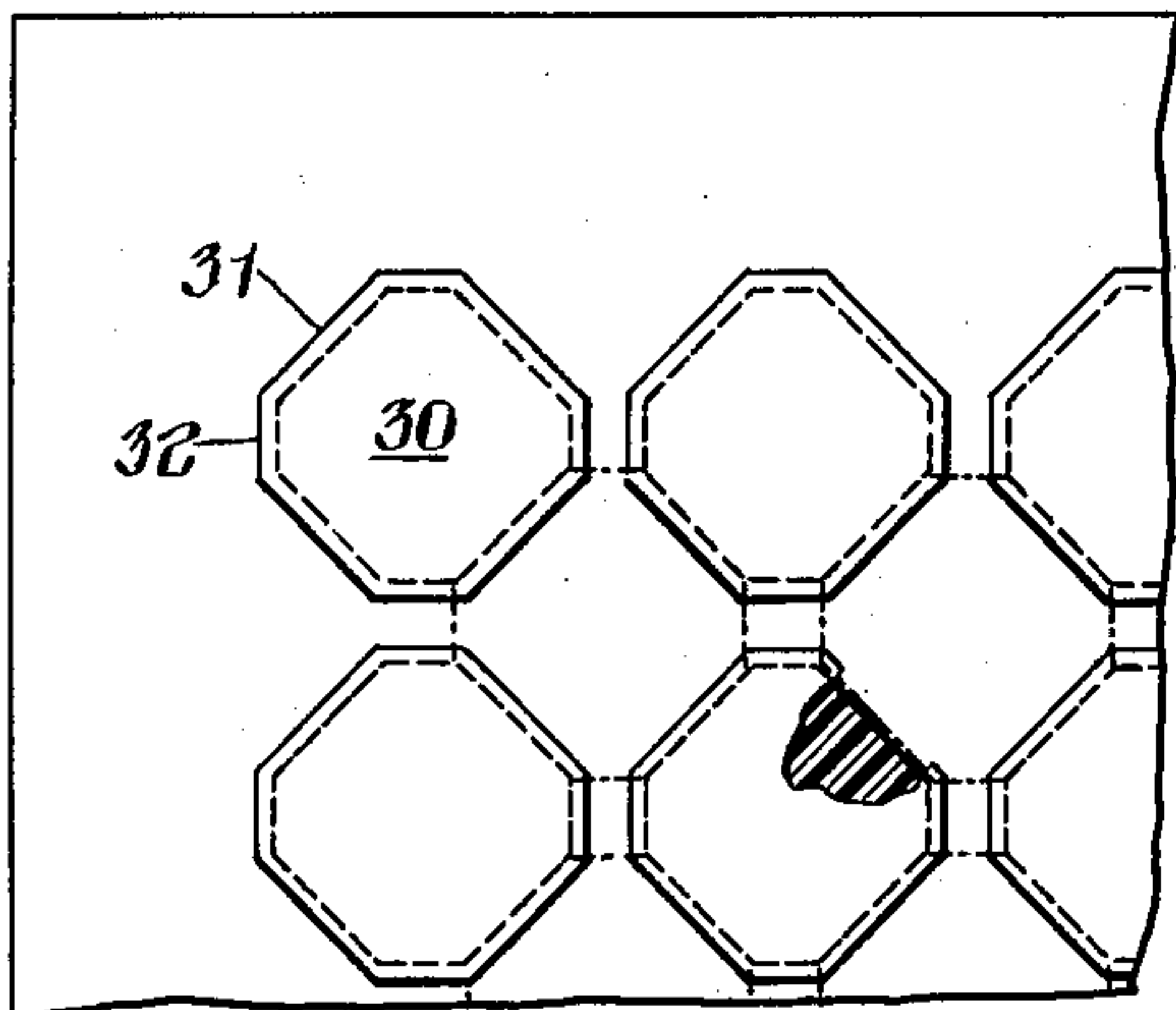


Fig. 6.

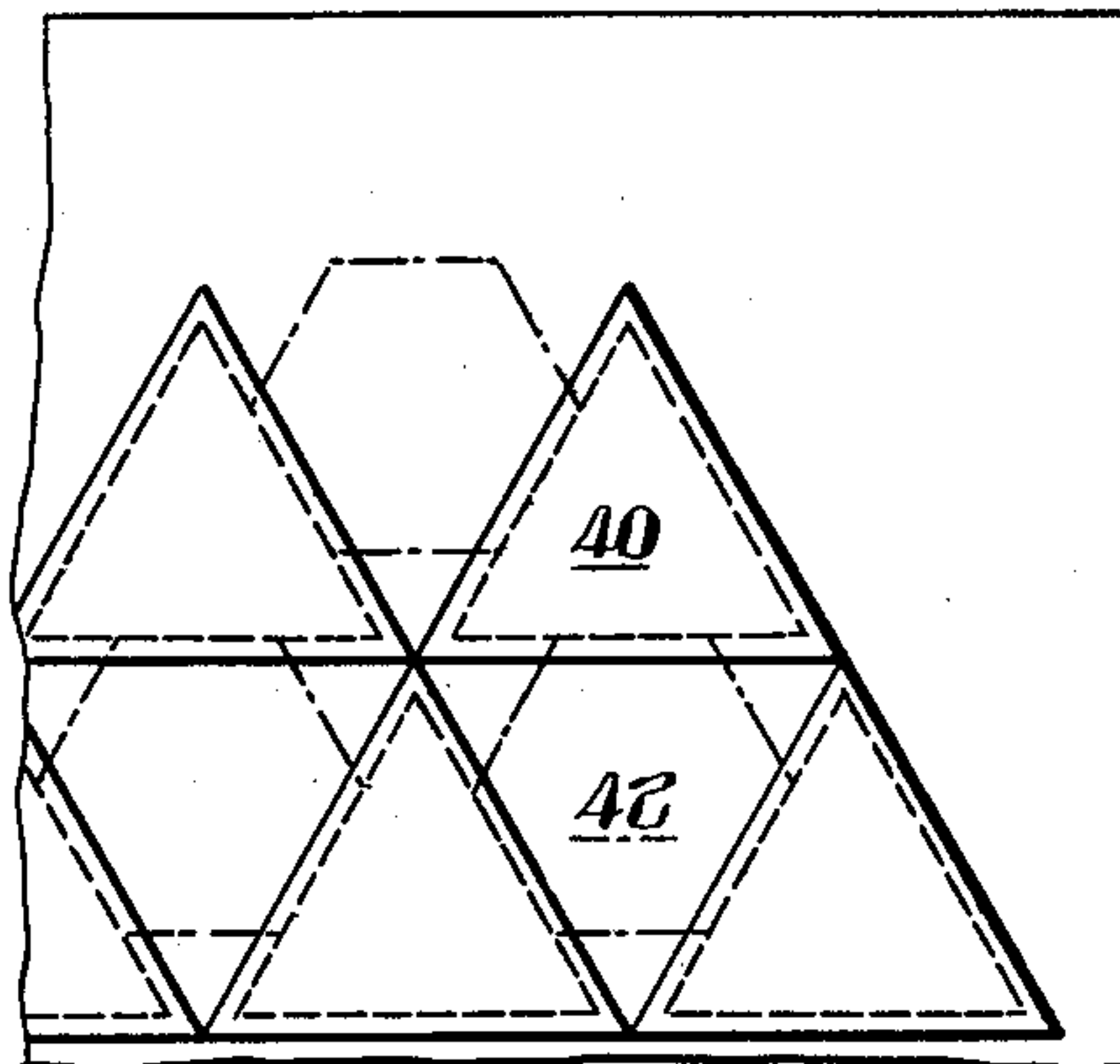


Fig. 7.

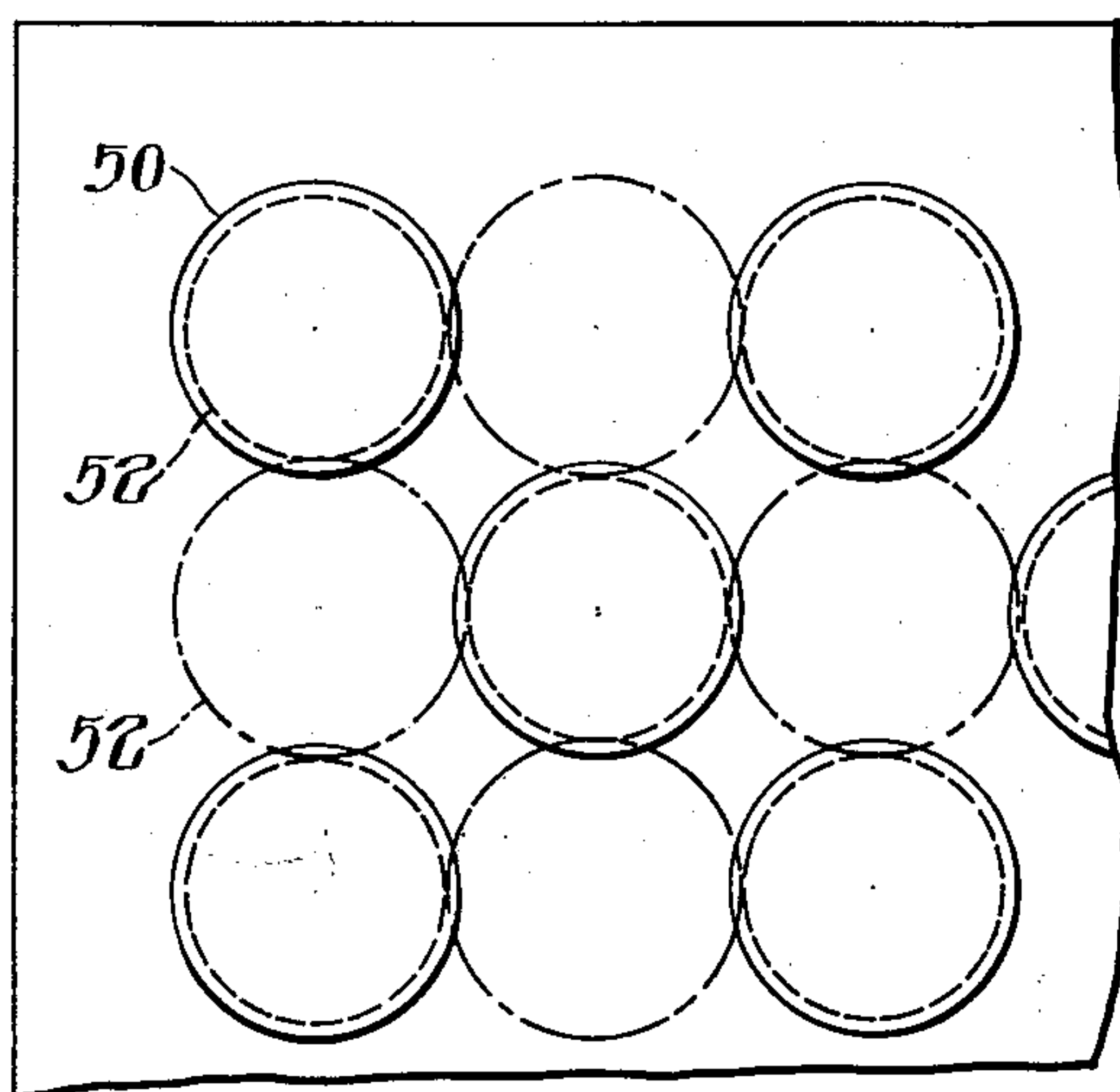


Fig. 8.

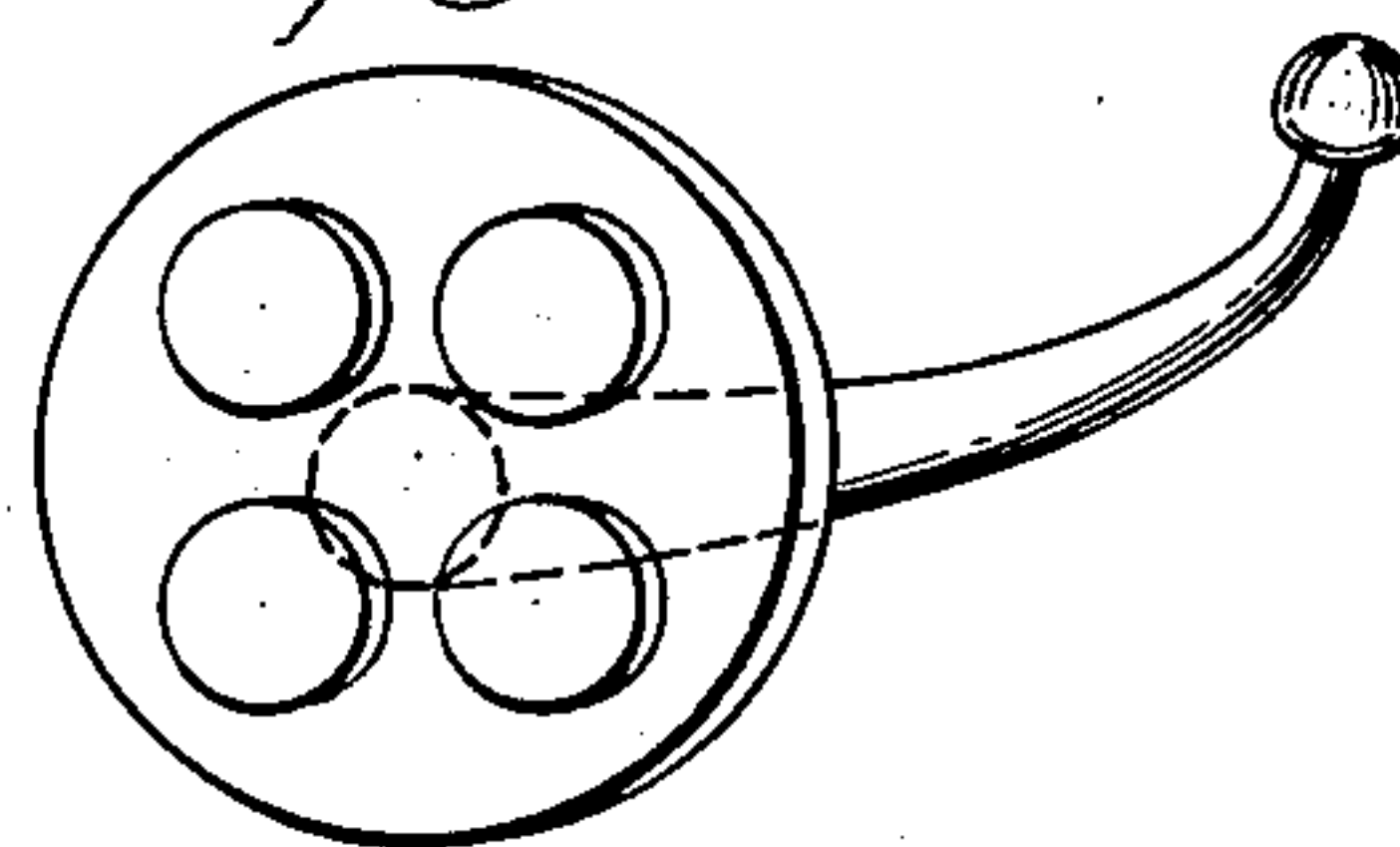
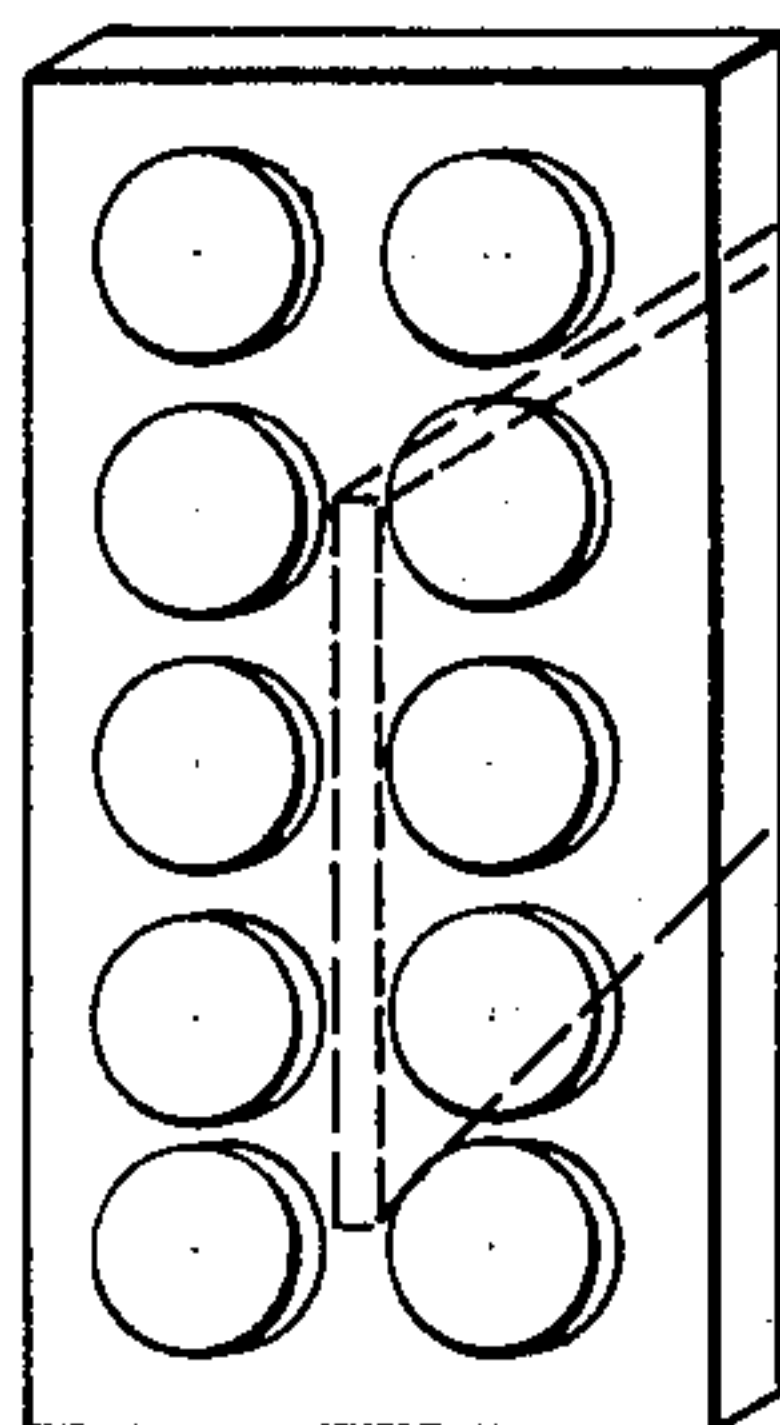


Fig. 9.



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FASTENER

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8 Claims. (Cl. 24-204)

This invention relates to fasteners, more particularly fasteners that are in the form of attachable and detachable members that interlock without using auxiliary members.

Among the objects of the present invention is the provision of novel fasteners that are simple to manufacture and use, yet are highly effective.

The above as well as additional objects of the present invention will be more clearly understood from the following description of several of its exemplifications, reference being made to the accompanying drawings, wherein:

FIG. 1 is an end elevation of one member of a fastener representative of the present invention;

FIG. 2 is a plan view of the fastener member of FIG. 1;

FIG. 3 is a view similar to FIG. 1 but taken along the line 3-3 of FIG. 2 and showing two identical members in face-to-face relation;

FIG. 4 is a view similar to FIG. 3 showing the two members fastened together;

FIG. 5 is a plan view of a modified member typical of the present invention;

FIGS. 6 and 7 are views similar to FIG. 5 illustrating further fastener modifications of the invention. FIG. 6 has the boss heads of one fastener member represented by full lines, the shanks of these bosses by dash lines and an interlocked member represented by dash-dot lines. FIG. 7 has the boss heads of one fastener member represented by full lines and the heads of an interlocked member by dash lines; and

FIGS. 8 and 9 are perspective views of members that can be detachably mounted in place pursuant to the present invention.

According to the present invention, a fastener has interlocking surface segments each with a multiplicity of yieldable upstanding bosses uniformly spaced from each other along the length and width of the surface, the spacing between the heads of the adjacent bosses on each surface segment being slightly less than the space occupied by the head of each individual boss on the other segment, and the heads of the bosses being enlarged slightly with respect to the shanks of the bosses to cause the boss heads of one segment to squeeze past the boss heads of the other segment when the two segments are pressed toward each other, to thereby interlock the segments.

The bosses are preferably of thermoplastic resin or rubber, natural or synthetic (butyl, butadiene-styrene, acrylonitrile etc. inasmuch as such materials have good elasticity and strength, will deform under reasonable forces to effect the interlocking, will resist unlocking once interlocked, and can be very readily placed in the desired shapes. Polyolefines such as polypropylene and polyethylene (low pressure as well as high pressure), polyamides (such as nylon 6), isocyanate polymers and polyvinyl chloride are among those suitable although other construction materials such as thermosetting resins (e.g. cross-linked unsaturated polyesters) can also be used. The more brittle materials are best avoided or used for fasteners that are interlocked for very infrequent unfastening.

Turning now to the construction of the drawings, that of FIGS. 1 and 2 is a fastener element having a body 10 with bosses 12 of generally cylindrical form but with their outer ends or heads 14 somewhat wider than their bases 16. The spacing between the bosses is such that the diagonal distance 20 between adjacent boss heads is less

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than the width of a head but approximately equal to the width of a boss base. The corresponding diagonal distance between boss bases should be approximately equal to the width of a boss head. This arrangement is readily provided by merely molding the fastener members so that the sides of the bosses have a linear taper of about 2 degrees, although small or larger tapers can also be used. The taper is shown by the rectilinear projection 22 of the boss heads in FIG. 1. As seen in vertical section, the boss sides need not be linear but can be curved concavely or convexly or can be stepped.

By bringing together two identical fastener members of the type, in face-to-face relation as illustrated in FIG. 3, it will be observed that the bosses can be oriented in rows so that the bosses in a diagonal row on one member are aligned with a row of bosses on the other member, the individual bosses being alternately on the respective members. Pressing the two members together when so aligned will cause these aligned bosses to squeeze past each other and reach the position shown in FIG. 4. In squeezing past, the bosses deform a little and the interlocking is effected somewhat more readily if the members are first pressed together at one of their ends and the pressure then moved along the length of the interlocking zone.

The interlocked members are extremely resistant to separation, particularly by forces directed transversely to the axes of the bosses, that is, parallel to the surfaces from which the bosses project. Separating forces directed opposite to the pressing that produced the interlocking, are also resisted unless such a separating force is concentrated at one end of the interlocked zone, and such a separating force is used to separate the members. They can be unpeeled from each other in this manner, without any difficulty.

The interlocking of the members is effected readily without taking the trouble to align their bosses, particularly if the width of the individual bosses is no more than about 1/8 inch or if the outer faces of the heads of the bosses are crowned so as to present convex self-aligning engagement to the bosses of another fastener member which may have flat or crowned boss heads.

The boss heads of the present invention can be as large as an inch or more in width, and they can be as small as 1/16 inch or less. Their height is preferably from about 1/8 to 3/8 inches, with the width from about 1/2 to about 3 times their heights.

In plan view the boss heads can be circular as in FIG. 2, or they can have other outlines. FIG. 5 shows a construction in which the heads 30 are octagonal in plan view. In this construction the sides of the octagon can be equal or alternately long and short, as indicated at 31, 32 respectively. The long sides are located so that they diagonally oppose the long side of adjacent boss heads inasmuch as this provides a larger peripheral engagement than can be provided by reducing the lengths of the octagonal edges 31.

In plan view the heads can also have other outlines such as elliptical, rectangular and triangular, and need not have symmetry of any kind. The bosses on one fastening member need not even be similar to the bosses of a mating fastener member.

FIG. 6 shows one example of a fastener assembly in which one of the members has triangular bosses 40 shown in full lines, and these triangles need not be equilateral. The bosses of an interlocking fastener member are shown in dash-dot lines 42 as hexagonal in plan view with the sides of the hexagon selected to fit between the triangular bosses. A feature of this embodiment of the invention is that the triangular bosses in one section of the fastener member on which they are carried will not

interlock with the same triangular bosses in another section of the same member. On the other hand the hexagons on the other member can be made interlocking with each other, or non-interlocking with each other, depending on the configuration and spacing of the triangles. When the triangles are equilateral and touch each other the hexagons will interlock with each other as well as with the triangles.

FIG. 7 illustrates a modification of the circular boss construction of FIG. 2. Whereas in FIG. 2 these bosses are arranged in rows with the bosses of adjacent rows forming columns that run at right angles to the rows, the rows of bosses in FIG. 7 make columns that run at an angle of 45 degrees with respect to the rows. The full line outlines 50 show one set of bosses and the dash line outlines 52 show the mating set of bosses. Other arrangements can also be used.

The fastener members of the present invention are readily made by standard molding techniques. Because of the deformability of the bosses, they can be pulled out of mold pockets notwithstanding the undercut shape of the pockets needed to form the bosses in their final configuration. Instead of molding or casting the fastener members directly in their final configuration, they can first be formed with untapered bosses, after which the boss heads can be heated and mushroomed slightly to provide the desired taper. Heat alone, if applied sufficiently to keep the boss heads above their flow point for a second or two will cause the heads to enlarge in width by melting down. The width enlargement will also be readily effected by lower temperatures if accompanied by a squeezing of the bosses as by a flat metal plate. The same plate can also be used to apply the heat.

One advantage in the use of the two-stage production is that the casting or molding of the first stage can be carried out with mold pockets that are not undercut and are therefore much simpler to prepare.

The fastener members of the present invention can also be made by a rolling operation. A wheel which can have its outer rim provided with properly spaced pockets for the bosses can be rolled in heated condition over a sheet of thermoplastic resin. The heated wheel is pressed against the resin sheet so that the rolling causes the surface of the sheet at which it engages the wheel, to be squeezed into the pockets and thereby form the bosses. The opposite surface of the sheet can be kept cool or contacted with a chilling roller, or the pocketed wheel can then be cooled to permit the rolled sheet with the bosses formed by rolling to be pulled away from the pocketed roller. Where the pockets are of the non-tapered kind, the boss-forming operation can be followed by another rolling operation in which the boss heads are pressed down by a heated roll to cause them to enlarge in width.

The fastener members of the present invention can be used in pairs to detachably fasten together all types of articles such as clothing, hold articles on wall panels, etc. They are also very effective for use by astronauts in getting about within space vehicles. By having the astronaut's shoes provided with a sole embodying the fastener structure of the present invention, and having the space vehicle walls, floor and ceiling formed with a mating fastener structure, the astronaut will be able to walk about these walls, floors and ceiling after a fashion, by merely engaging his shoes with those surfaces one step at a time and then disengaging them. This arrangement avoids the use of the heavy magnetic equipment otherwise considered necessary for the same purpose.

In articles of clothing or the like, the fastener members can be sewn or fused in place. For sewing purposes the bases 10 of the fastener members are desirably of impregnated textile construction or have fibers distributed through them to increase the tear resistance between stitching holes.

One very practical embodiment of the invention is in connection with belts to be worn around the waist. A sheet of nylon or other thermoplastic resin can be very simply rolled to provide bosses on both its flat surfaces. The sheet can then be slit into individual narrow strips each long enough to be a single belt. The resulting strips can then be placed around the waist and secured by pressing the bosses at one end into interlocking engagement with the bosses on the opposite face at the other end of the belt. The bosses can be confined to the ends of the belt but can also be extended over one or both entire surfaces. The outer end of the belt will then be partly held against the outer face of an inner section and will not dangle or interfere with other clothing.

The above belt can also be used for wrapping packages or the like. It can be made of very thin sheet material in which case it will be so inexpensive as to be discardable after a single use, if desired. Where the maximum resistance to detachment is desired the bosses can have stepped shanks with the steps symmetrical so that they mate with each other when the bosses reach interlocking engagement. For this symmetrical step arrangement, there can be a single step mid-way up the boss height, two steps equally spaced respectively from the top and bottom of the boss, a combination of the above single and two-step arrangements, etc.

FIGS. 8 and 9 illustrate a hook and a shelf bracket, respectively that can be detachably mounted on wall panels having the construction shown in FIG. 2 above. Such panels can be conveniently secured to walls or even ceilings as by cementing or nailing or the like and make decorative surfacings upon which utensils, tools, shelves, pictures etc. can be mounted very conveniently and rearranged when desired. Such panels also have a desirable effect in reducing acoustic echoes.

Obviously many other modifications and variations of the present invention are possible in the light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A fastener comprising a pair of interlocking surface segments each having a multiplicity of yieldable upstanding bosses at least about $\frac{1}{16}$ of an inch in width uniformly spaced from each other along the length and width of the surface to be equidistant from each other, all of said bosses being of substantially the same height, each said boss being essentially symmetrical with respect to a center axis extending essentially perpendicular to said surface segments, the distance between the center axes of the bosses on one of said segments being substantially equal to the distance between the center axes of the bosses on the other of said segments, the spacing between the heads of the individual bosses on each one of said segments being slightly less than the space occupied by the head of each boss on the other one of said segments, the individual bosses of each segment having substantially rectilinearly tapered lateral engaging portions with the taper thereof extending substantially uniformly and continuously from the head to the segment thereof with the heads of the individual bosses being enlarged slightly with respect to the shanks of the bosses whereby the boss heads of one segment squeeze past the boss heads of the other segment when the two segments are pressed toward each other to thereby tightly interlock the segments, and the taper of the individual bosses for said segments being substantially identical.

2. The combination of claim 1 in which the bosses are thermoplastic resin and are integral with their surface segments.

3. The combination of claim 2 in which the resin is a polyolefine selected from the class of polyethylene and polypropylene.

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4. The combination of claim 2 in which the resin is a polyamide.

5. The combination of claim 2 in which the resin is polyvinyl chloride.

6. The combination of claim 1 in which the boss heads are rounded in plan view. 5

7. The combination of claim 1 in which the boss heads have their interlocking peripheries rounded in sectional view.

8. The combination of claim 2 in which the bosses are 10 1,064,360

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between about $\frac{1}{8}$ and $\frac{3}{8}$ inches high and have a width of from about one-half to about three times their height.

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