

APPLICATION ACCEPTED AND AMENDMENTS

ALLOWED 19-2-90

FORM 1

597706

SPRUSON & FERGUSON

COMMONWEALTH OF AUSTRALIA

76580/87

PATENTS ACT 1952

APPLICATION FOR A STANDARD PATENT

LODGED AT SUB-OFFICE  
5 AUG 1987  
Sydney

Minnesota Mining and Manufacturing Company, incorporated in Delaware, of 3M Centre Saint Paul, Minnesota, 55144, UNITED STATES OF AMERICA, hereby apply for the grant of a standard patent for an invention entitled:

An Intermeshable Article

which is described in the accompanying complete specification.

Details of basic application(s):-

Basic Applic. No: 904358 Country: UNITED STATES OF AMERICA

Application Date: 8 September 1986

The address for service is:-

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DATED this FIFTH day of AUGUST 1987

Minnesota Mining and Manufacturing Company

By:

*M. J. Anderson*

Registered Patent Attorney

TO: THE COMMISSIONER OF PATENTS  
OUR REF: 33870  
S&F CODE: 58400



FEE STAMP TO VALUE OF  
\$ 170 ATTACHED  
MAIL OFFICER

5845/2

COMMONWEALTH OF AUSTRALIA  
THE PATENTS ACT 1957  
DECLARATION IN SUPPORT OF A  
CONVENTION APPLICATION FOR A PATENT  
In support of the Convention Application made for a  
patent for an invention entitled:

AUSTRALIA  
CONVENTION  
STANDARD  
& PETTY PATENT  
DECLARATION  
SPF-4

Title of Invention "AN INTERMESHABLE ARTICLE"

Full name(s) and address(es) of Declarant(s)  
I-We Donald Miller Sell, Chief Patent Counsel  
care Minnesota Mining and Manufacturing Company  
of 3M Centre, Saint Paul, Minnesota 55144  
United States of America

do solemnly and sincerely declare as follows:-

Full name(s) of Applicant(s)

1. I am/We are the applicant(s) for the patent

(or, in the case of an application by a body corporate)

1. I am/We are authorised by MINNESOTA MINING AND MANUFACTURING COMPANY

the applicant(s) for the patent to make this declaration on its/their behalf.

2. The basic application(s) as defined by Section 141 of the Act was/were made

in United States of America

on 8 September, 1986

by ROGER H. APPELDORN

Basic Country(ies)

Priority Date(s)

Basic Applicant(s)

Full name(s) and address(es) of inventor(s)

3. I am/We are the actual inventor(s) of the invention referred to in the basic application(s)

(or where a person other than the inventor is the applicant)

3. ROGER HENRY APPELDORN

care Minnesota Mining and Manufacturing Company  
of 3M Center, St. Paul, Minnesota 55144-1000  
United States of America

(respectively)

is/are the actual inventor(s) of the invention and the facts upon which the applicant(s) is/are entitled to make the application are as follows:

The said Company is the assignee of the actual inventor.

Set out how Applicant(s) derive title from actual inventor(s) e.g. The Applicant(s) is/are the assignee(s) of the invention from the inventor(s)

4. The basic application(s) referred to in paragraph 2 of this Declaration was/were the first application(s) made in a Convention country in respect of the invention(s) the subject of the application.  
St. Paul,

Declared at Minnesota, this 16th day of July 19 87.  
U.S.A.

Donald Miller Sell

Signature of Declarant(s)  
Chief Patent Counsel

To: The Commissioner of Patents

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**(12) PATENT ABRIDGMENT (11) Document No. AU-B-76580/37**  
**(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 597706**

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(54) Title  
**AN INTERMESHABLE ARTICLE**

International Patent Classification(s)  
(51)<sup>4</sup> **F16B 011/00**

(21) Application No. : **76580/87**

(22) Application Date : **05.08.87**

(30) Priority Data

(31) Number	(32) Date	(33) Country
<b>904358</b>	<b>08.09.86</b>	<b>US UNITED STATES OF AMERICA</b>

(43) Publication Date : **10.03.88**

(44) Publication Date of Accepted Application : **07.06.90**

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**SPRUSON & FERGUSON**

(56) Prior Art Documents  
**US 3101517**  
**DE 1807993**  
**DE 1915098**

(57) Claim

1. An article adapted to intermesh with a corresponding substantially identical article, said article comprising a solid base portion and a plurality of tapered elements extending from said base each of said tapered elements terminating in a planar portion, respective said planar portions being substantially co-planar, each said element having at least one side inclined relative to its respective planar portion at an angle  $\beta$  sufficient to form said taper so that said elements may mesh with corresponding elements of a corresponding said article, said article being adapted to adhere to said corresponding article at least partially because of the frictional characteristics of the contacting surfaces of said corresponding elements, the tangent of said angle  $\beta$  being no greater than the coefficient of friction of the contacting surface of said element.

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S & F Ref: 33870

FORM 10

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

COMPLETE SPECIFICATION

(ORIGINAL)

FOR OFFICE USE:

Class Int Class

Complete Specification Lodged:  
Accepted:  
Published:

Priority:

Related Art:

This document contains the  
amendments made under  
Section 49.

and is correct for printing.

Name and Address  
of Applicant:

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Complete Specification for the invention entitled:

An Intermeshable Article

The following statement is a full description of this invention, including the  
best method of performing it known to me/us

## AN INTERMESHABLE ARTICLE

### Field of the Invention

The present invention relates to intermeshable  
5 articles, and in one aspect to articles having a structured  
surface on one side. The structured surface of such an  
article may be brought into contact with itself, another  
similar article or the structured surface of a dissimilar  
article for a multitude of purposes, such as, for example,  
10 fastening.

### Background of the Invention

There are a number of ways known by those skilled  
in the art to fasten, couple, or connect items. For  
15 example, it has been proposed to taper the sides of a shaft  
so that the head portion consisting of, for example, a  
toothbrush or tool, may be attached thereto, while  
permitting removal and interchange of the head portion, as  
disclosed in U.S. Pat. Nos. 1,987,913 (Bell), 3,039,340  
20 (Livermont), 3,182,345 (Smith) and 3,369,265 (Halberstadt  
et al). Also, intermeshing joints have been utilized for  
connecting in woodworking, as disclosed in U.S. Pat. Nos.  
1,212,262 (Rockwell), 1,214,261 (Balbach), 1,342,979  
(Beitner) and 1,954,242 (Heppenstall), and in meta-  
25 working, as disclosed in U.S. Pat. No. 2,895,753 (Fentiman)  
and 3,000,658 (Sprouse). Further, inclined or tapered  
shafts have been utilized for interconnecting the ends of  
leather washers, as illustrated in U.S. Pat. No. 281,760  
(Gingras). However, all of the above have utilized a  
30 single shaft and, in some instances, either provided  
protruding elements along the sides or a T-shaped like-end  
to provide additional mechanical interference to enhance  
fastening.

In addition, several fasteners have been  
35 disclosed in the art for attaching items together. For

example, loops and hooks have been utilized whereby when the hooks are brought into contact with the loops the former interlocks with the latter, as disclosed in U.S. Pat. Nos. 2,717,437 (Mestra) and 3,009,235 (Mestra). Also, 5 a plurality of macro asperities or protrusions have been utilized which may either be brought into contact with similarly shaped macro asperities or with correspondingly shaped recesses, as disclosed in U.S. Pat. Nos. 2,499,898 (Anderson), 3,192,589 (Pearson), 3,266,113 (Flanagan, Jr.), 10 3,408,705 (Kayser et al.), and 4,520,943 (Nielsen). In addition, fasteners utilizing a plurality of longitudinally extending rib and groove elements which deform and mechanically interfere and resiliently interlock with each other have been disclosed, for example, in U.S. Pat. Nos. 15 2,144,755 (Freedman), 2,558,367 (Madsen), 2,780,261 (Svec et al.), 3,054,434 (Ausnit et al.), 3,173,184 (Ausnit), 3,198,228 (Naito) and 3,633,642 (Siegel).

Further, containers of the type commonly known as "Tupperware" containers (Tupperware is a registered 20 trademark of Kraft, Inc.) and the many similar containers are disclosed, for example, in U.S. Pat. Nos. 2,487,400 (Tupper), 3,335,774 (Reed), 3,618,802 (Yates, Jr.), 3,730,382 (Heisler), and 3,817,420 (Heisler). The covers of such containers are precisely sized and when mounted, 25 the covers are stretched to cause a tension to be developed in the cover rims between inner and outer retaining lip portions to provide mechanical interlocking for closure.

#### Summary of the Invention

30 In contrast to the ways of fastening, closing, coupling and connecting of the prior art acknowledged above, the article of the present invention provides a way of adhering the article to itself, another similar article or the structured surface of a dissimilar article at least 35 partially because of the frictional characteristics of the material of the adhering items. In addition, because adherence is related to friction, no macro deformation or mechanical interference is required.

The intermeshable article of the present invention includes a member which has at least one major surface and at least a portion of that surface is a structured surface. The structured surface is made up of a plurality of tapered elements. Each element has at least one side inclined relative to the plane of the member at an angle sufficient to form a taper such that each element will mesh with at least one corresponding element when brought into contact with the corresponding element and adhere thereto at least partially because of the frictional characteristics of the contacting surfaces.

There are a multitude of potential uses for the above described intermeshable article where it may be desirable to bring the structured surface of the article into contact with itself, another similar article or the structured surface of a dissimilar article for fastening, closing, coupling and connecting, to name but a few.

Brief Description of the Drawings

The present invention will be more fully described with reference to the accompanying drawings wherein like reference numerals identify corresponding components, and:

Figure 1 is an enlarged perspective view of the intermeshable article of the present invention;

Figures 2, 3, and 4 are cross-sectional views of the article illustrated in Figure 1 showing a progression of two similar articles being brought into contact with one another;

Figure 5 is an enlarged cross-sectional view of the elements of the article of the present invention depicted in Figure 1;

Figure 6 is an enlarged cross-sectional view illustrating a variation of the elements of the present invention;

Figures 7 and 8 are cross-sectional views of alternate embodiments of the article of the present invention; and

Figures 9 and 10 are plan views of alternate embodiments of the article of the present invention.

Detailed Description of the Preferred Embodiment

5 Referring to Figure 1 of the drawings, an intermeshable article of the present invention, generally designated 20, is illustrated. The article includes a member which has two major surfaces 22 and 23, and at least one of which is a structured surface 24. The structured  
10 surface includes a plurality of tapered elements 26, and each element has at least one side 28. In the illustrated article 20, the elements 26 each have two sides and are arranged side by side to form a plurality of linear ridges 30 and grooves 32.

15 The sides 28 of each element are inclined relative to the plane of the article at an angle sufficient to form a taper such that each element will mesh with at least one corresponding element of, for example, another similar article 20', as illustrated in Figures 2, 3 and 4.  
20 Then when they are brought into contact with one another, the elements will adhere to one another, at least partially, because of the frictional characteristics of the contacting surfaces without macro deformation, or mechanical interference or interlocking of the elements  
25 being required. However, it is believed that deformation of any surface irregularities or random micro asperities does take place, but only on a microscopic scale which contributes to adherence by increasing the amount of actual area contact between the surfaces. Thus, it is preferred  
30 that the contacting surfaces be optically smooth to decrease macro deformation and to increase adherence for some applications.

With reference to Figure 5, it has been observed that when the tangent of the half angle  $\beta$  is approximately  
35 equal to or less than the coefficient of friction  $\mu$  of the material of the contacting surfaces, adherence between the two articles 20 and 20' is substantially increased. Thus,



one can utilize the relationship between the coefficient of friction  $\mu$  and the total included angle  $\alpha$  in designing articles by the following equations:

5

$$(1) \mu = \frac{L}{H}$$

$$(2) \mu = \tan \frac{\alpha}{2}$$

$$(3) \alpha = 2 \arctan \mu$$

10 where  $\beta = \frac{\alpha}{2}$  and the slope of the taper =  $\frac{L}{H}$ .

In the preferred embodiment, as illustrated in Figure 1 and in greater detail in Figure 5, each groove 32 is provided with a trough 34 which separates adjacent elements. Also, each element 26 is sized such that when the elements are brought into contact with one another to mesh, they will contact each other only along the sides of elements. This provides a cavity 36, as illustrated in Figure 4, and facilitates adherence, the degree of which may vary depending upon the angle of the taper and/or the frictional forces associated with the sides of the intermeshing elements. The cavity 36 insures side contact. Each ridge 30 and trough 34 can touch (not shown) as long as the force associated therewith is not greater than the force associated with the sides 28. To facilitate alignment of the elements 26, each ridge may include a portion which may be curved or inclined to form, for example, a chamfered portion 38 as illustrated in Figure 6.

In addition, as illustrated in Figure 7, the elements 26' may be canted with respect to the perpendicular axis of each element relative to the plane of the article to provide directionability of adherence and repositionability.

It should be appreciated that the present invention should not be limited to rows of two sided elements arranged side by side, but may include a number of configured elements such as circular or polygonal as long as each has at least one side as, for example, illustrated

in Figures 9 and 10 which may be used for adherence. In Figure 9, rows of four sided elements 26 are arranged so that they may mesh with corresponding elements when brought into contact therewith. Also, as illustrated in Figure 10, a plurality of six sided elements 50 may be arranged adjacent one another. Alternatively, the elements of one article may be positive elements and the elements of the other article may be negative elements so that the positive elements may mesh with the negative elements to adhere thereto.

The particular material used for the article 20 may vary and is not essential to the present invention. Thus, ceramics, glasses, polymers and metals, for example, may be useful. However, polymeric materials, such as commercially available acrylics, vinyls, polyethylenes and polycarbonates, have been found to be useful. Normally, the manufacturers of this product will select the best commercially available material based upon price, application and manufacturing process. In addition, for specialty applications, materials which are biodegradeable, conductive or magnetic may also be useful.

There are several ways to mass produce the articles 20 of the present invention which are well known to those skilled in the art, for example, as illustrated in U.S. Patent Nos. 3,689,346 (Rowland), 4,244,683 (Rowland), 4,576,850 (Martens) and U.K. Patent Application No. GB 2,127,344 A (Pricone et al.), the disclosures of which are hereby incorporated by reference. The particular manufacturing process is not essential to the present invention, and is a matter of choice based upon economics and availability. Presently, prototypes have been made by compression molding sheets of polymethyl methacrylate (PMMA), polyvinyl chloride (PVC) and polyethylene.

The thickness of the article 20 may vary depending upon the particular application, such as a fastener. Thus, the article 20, for some applications, may

be formed of a thin, flexible sheet or film so that it can be flexed to allow separation and repositioning of the article.

5

#### Application and Use

There are a multitude of potential uses for the article 20 of the present invention, the most promising of which, due to its ability to mesh and releasably adhere, is as a fastener for such things as, for example, reclosable  
10 bags, tapes, and closures, to name but a few. In addition, the structured surface of the article 20 may be brought into contact with itself, another similar article 20 or the corresponding structured surface of a dissimilar article or item, such as a container.

15

As illustrated in Figure 8, to facilitate placement of such an article a suitable means for mounting the article, such as a coating 40 of an adhesive composition, may be placed on one side 23 of the article. The particular adhesive is not essential to the present  
20 invention and may include, for example, ultraviolet curable adhesives of the type disclosed in U.S. Patent No. 4,330,590 (Vesley), the disclosure of which is hereby incorporated by reference. To protect the coating 40, a protective film 42 may be bonded thereto. It is preferred  
25 that the film 42 have a release surface to permit it later to be peeled away to expose the adhesive coating so that the article 20 may then be adhered to items. Useful films include, for example, polycarbonate, polymethyl methacrylate, polystyrene, and biaxially-oriented  
30 polyethylene terephthalate. In addition, paper or other nonwoven films having a suitable release coating may be used.

Objects and advantages of the invention are further illustrated by the following examples, but the  
35 particular material recited in these examples, as well as other conditions and details, should not be construed to unduly limit this invention.

Example 1

Two pieces of intermeshable articles 20, of the type illustrated in Figure 5, were tested for tensile strength and peel strength. Both pieces were of polyvinyl chloride (PVC) having 50 elements per centimeter.

Example 2

Two pieces of intermeshable articles 20, of the type illustrated in Figure 6, were tested for tensile strength and peel strength. Both pieces were of polyvinyl chloride (PVC) having 50 elements per centimeter.

A 10 pound peel tester was used to test various samples from Example 1 and Example 2. The results revealed that more tensile force was needed to break the bond when pulled axially with respect to the grooves. Also, repeatedly separating the grooved material appeared to have no effect on either the tensile or peel strength of the material.

While a preferred embodiment of the present invention has been described so as to enable one skilled in the art to practice the techniques of the present invention, the preceding description is intended to be exemplary and should not be used to limit the scope of the invention. The scope of the invention should be determined only by reference to the following claims.

30

35

The claims defining the invention are as follows:

1. An article adapted to intermesh with a corresponding substantially identical article, said article comprising a solid base portion and a plurality of tapered elements extending from said base each of said tapered elements terminating in a planar portion, respective said planar portions being substantially co-planar, each said element having at least one side inclined relative to its respective planar portion at an angle  $\beta$  sufficient to form said taper so that said elements may mesh with corresponding elements of a corresponding said article, said article being adapted to adhere to said corresponding article at least partially because of the frictional characteristics of the contacting surfaces of said corresponding elements, the tangent of said angle  $\beta$  being no greater than the coefficient of friction of the contacting surface of said element.

2. An article as defined in claim 1, further characterized in that each element has two sides and said plurality of elements are arranged side by side to form a plurality of linear ridges and grooves, and the sides of adjacent elements form the sides of each groove.

3. An article as defined in claim 2, further characterized in that the force associated with the sides of the meshing elements of two said articles is greater than the force associated with the ridges and with troughs located at the opposite ends of said grooves from said ridges.

4. An article as defined in claim 2, further characterized in that each element is nonsymmetric and canted with respect to the perpendicular axis of each element relative to the planar portion thereof.

5. An article as defined in claim 2, further characterized in that said ridges are truncated.

6. An article as defined in claim 5, further characterized in that said elements are chamfered to facilitate alignment of said elements with the elements of said corresponding article.

7. An article as defined in claim 2, further characterized in that each groove further comprises a trough between the sides of said grooves to provide a cavity when said elements are brought into contact with one another.

8. An article as defined in claim 1, further characterized in that said base includes two major surfaces, namely that from which said elements extend and a second opposite surface, both major surfaces being structured

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surfaces.

9. The article defined in claim 8, further characterized in that each groove further comprises a trough between the sides of successive said grooves to provide a cavity when said elements are brought into contact with the elements of a corresponding article.

10. The article defined in claim 1, further characterized by mounting means associated with the surface of at least one of said elements for mounting said article.

11. The article defined in claim 1, fabricated at least partially of a polymeric material.

12. An article as defined in claim 1 and substantially as described herein with reference to and as illustrated by FIGS. 1 to 5 or any one of FIGS. 6 to 10 of the accompanying drawings.

DATED this NINTH day of FEBRUARY 1990  
Minnesota Mining and Manufacturing Company

Patent Attorneys for the Applicant  
SPRUSON & FERGUSON

JMR/1034



76580/87

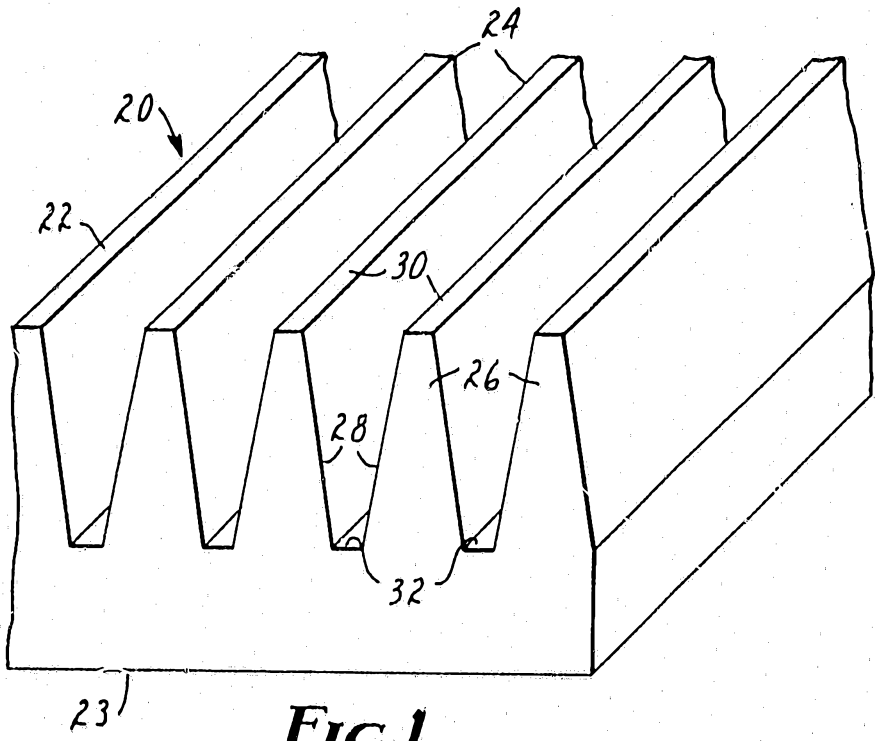


FIG. 1

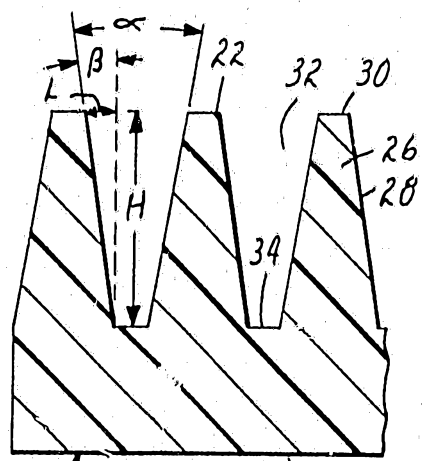


FIG. 5

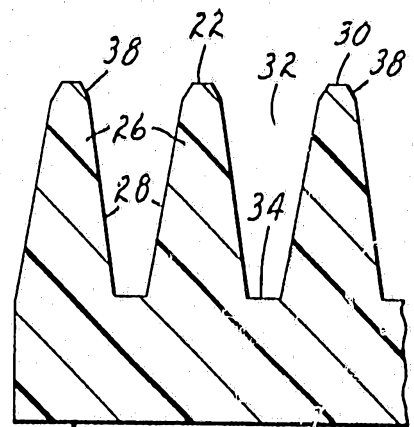
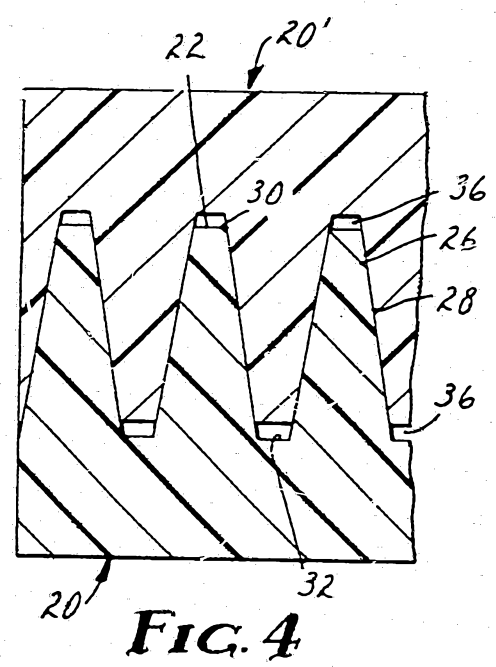
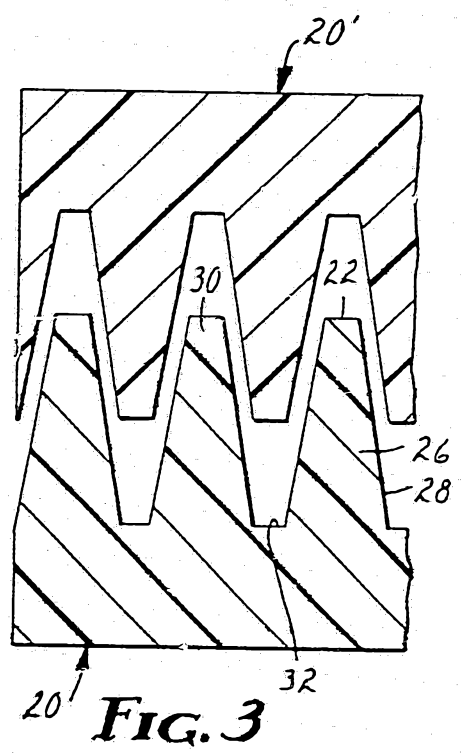
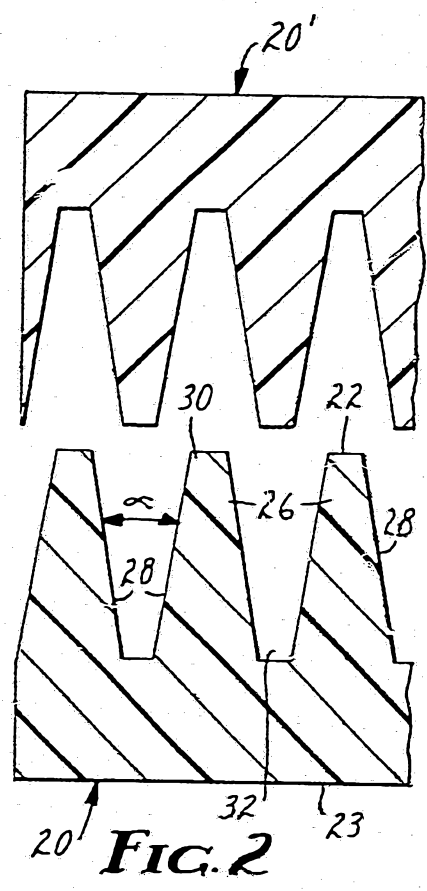
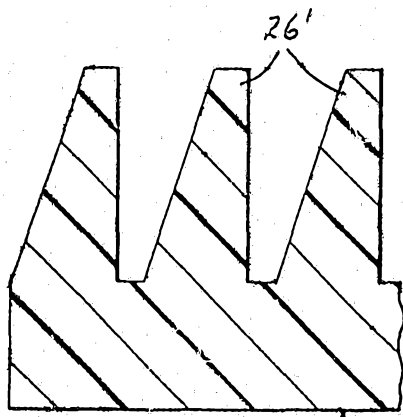


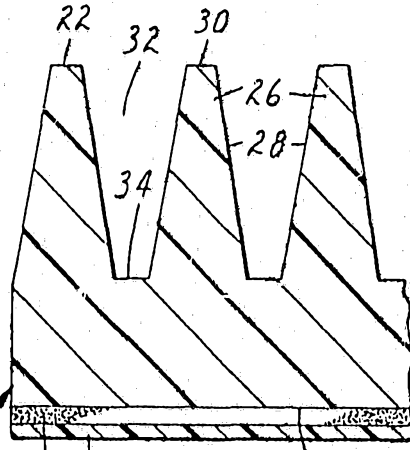
FIG. 6



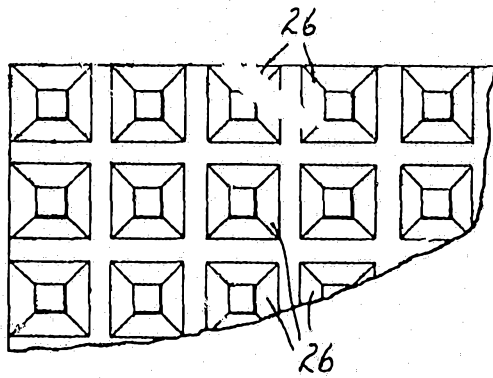




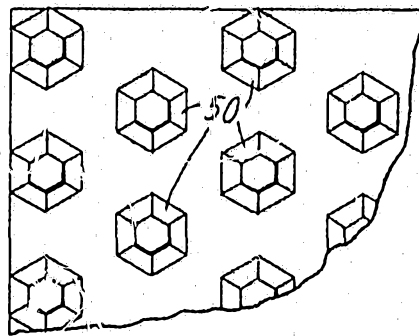
**FIG. 7**



**FIG. 8**



**FIG. 9**



**FIG. 10**