



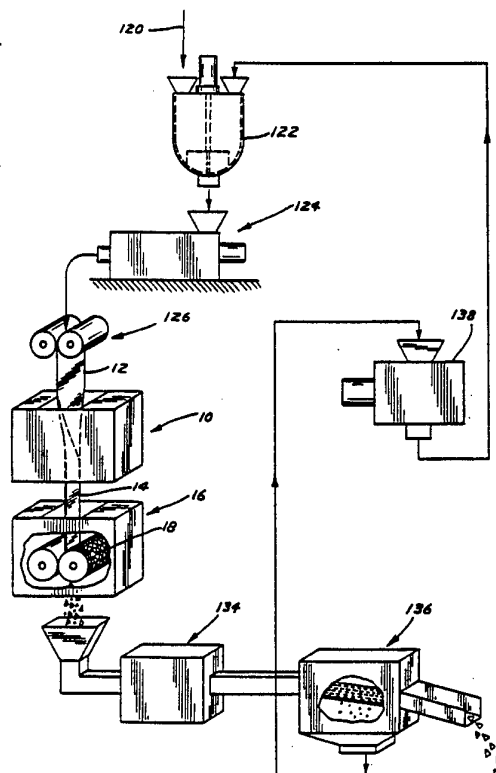
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁵ : A21C 11/02, 11/10</p>	<p>A1</p>	<p>(11) International Publication Number: WO 94/00017 (43) International Publication Date: 6 January 1994 (06.01.94)</p>
<p>(21) International Application Number: PCT/US93/05937 (22) International Filing Date: 22 June 1993 (22.06.93) (30) Priority data: 07/903,294 24 June 1992 (24.06.92) US (60) Parent Application or Grant (63) Related by Continuation US 07/903,294 (CIP) Filed on 24 June 1992 (24.06.92) (71) Applicant (for all designated States except US): GENERAL MILLS, INC. [US/US]; Number One General Mills Boulevard, P.O. Box 1113, Minneapolis, MN 55440 (US).</p>	<p>(72) Inventors; and (75) Inventors/Applicants (for US only) : BORNHORST, Bill [US/US]; 11714 Sunset Trail, Plymouth, MN 55441 (US). CARSTENSEN, Mary, Kay [US/US]; 5012 New Kent Road, Richmond, VA 23225 (US). WALDHERR, Mike [US/US]; 8444 Yates Avenue North, Brooklyn Park, MN 55443 (US). STEIN, Steve [US/US]; 2006 Westridge Court, Buffalo, MN 55313 (US). (74) Agents: LILLEHAUGEN, L., MeRoy et al.; General Mills, Inc., MGO-4SE, P.O. Box 1113, Minneapolis, MN 55440 (US). (81) Designated States: AT, AU, BB, BG, BR, CA, CH, CZ, DE, DK, ES, FI, GB, HU, JP, KP, KR, LK, LU, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SK, UA, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i></p>	

(54) Title: APPARATUS AND METHODS FOR RECOUPING SCRAP DOUGH MATERIAL

(57) Abstract

Apparatus and methods of fabricating half products in the field of puffed snack piece fabrication are disclosed including a rotary cutter (16) having an opposed pair of rollers (18). At least one of the rollers (18) of the rotary cutter (16) has cavities (112) arranged in a first portion (110) which stamp out first pieces and cavities (118) arranged in second and third portions (114, 116) for stamping out second pieces from the remaining portions of a continuous dough sheet (14). The first pieces are of the desired shape and size for the half products, and the second pieces are of a size and shape mechanically separable from the first pieces. After stamping, the first and second pieces are dried in an oven (134) and then separated by a separator (136). The dried first pieces form the half product. The dried second pieces can be ground in a grinder (138) and added to the ingredients (120) forming the dough prior to or during mixing in mixer (122).



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	FR	France	MR	Mauritania
AU	Australia	GA	Gabon	MW	Malawi
BB	Barbados	GB	United Kingdom	NE	Niger
BE	Belgium	GN	Guinea	NL	Netherlands
BF	Burkina Faso	GR	Greece	NO	Norway
BG	Bulgaria	HU	Hungary	NZ	New Zealand
BJ	Benin	IE	Ireland	PL	Poland
BR	Brazil	IT	Italy	PT	Portugal
BY	Belarus	JP	Japan	RO	Romania
CA	Canada	KP	Democratic People's Republic of Korea	RU	Russian Federation
CF	Central African Republic	KR	Republic of Korea	SD	Sudan
CG	Congo	KZ	Kazakhstan	SE	Sweden
CH	Switzerland	LI	Liechtenstein	SI	Slovenia
CI	Côte d'Ivoire	LK	Sri Lanka	SK	Slovak Republic
CM	Cameroon	LU	Luxembourg	SN	Senegal
CN	China	LV	Latvia	TD	Chad
CS	Czechoslovakia	MC	Monaco	TG	Togo
CZ	Czech Republic	MG	Madagascar	UA	Ukraine
DE	Germany	ML	Mali	US	United States of America
DK	Denmark	MN	Mongolia	UZ	Uzbekistan
ES	Spain			VN	Viet Nam
FI	Finland				

-1-

1 Apparatus and Methods for Recouping Scrap Dough Material
BACKGROUND

5 The present invention generally relates to apparatus and methods for recouping scrap material, and particularly to apparatus and methods for recouping scrap material remaining after the desired shaped and sized pieces are cut from a continuous dough sheet for the preparation of a snack product by conventional deep fat frying.

10 One type of snack product which has gained wide market acceptance is the "puffed" snack product. In certain methods of preparation, a cooked farinaceous dough is formed into a single continuous dough sheet. This dough sheet is then run through a piece forming apparatus or rotary cutter which includes an opposed pair
15 of rollers at least one of which has depressions which stamp out the desired shape and size pieces from the dough sheet. After formation of the dough pieces, the pieces are dried under controlled conditions from a moisture content of about 18% down to a moisture content
20 of between 10% and 15% to form a half product or pellet. The moisture content of the half product is sufficiently low to exhibit extended shelf stability. The snack

-2-

1 product is prepared from the half product by conventional
deep fat frying. The frying of the half product generates
steam volumes inside of the half product to puff the half
product resulting in a light, puffed snack product having
5 surface corrugations.

The sale of snack food products is a highly
competitive business. The novelty of snack food products
decline rapidly, as new and different types of snack
foods are introduced to maintain or increase market share.
10 Puffed snack products can be varied in various ways such
as by changing the shapes, sizes, and surface corrugations
of the pieces or by changing the composition of the dough
from which the half products are prepared. Another
variation is to have the puffed snack product of a hollow
15 structure, with the hollow configuration resulting from
the fabrication of the half products from a two-layer
laminated dough sheet. One method of forming a laminated
dough sheet is to fold a single continuous dough sheet
into a two-ply dough sheet as set forth in U.S. Patent
20 Nos. 5,092,757 and 5,217,739.

As set forth previously, the frying of the half
product generates steam volumes inside of the half
product to puff the half product. If the half product is
not completely whole in shape, the resulting puffed snack
25 product will not have consistent size and shape. This is
especially important for the two-ply half product where
the steam generated inside of the half product results in
a unique, slightly pillowed, crisp, puffed snack product,
with half products which are not formed properly such as
30 not being completely whole in shape not producing product
having this appearance which are preferred by the
consumer. To insure that all pieces are completely
formed and possess the desired texture and appearance,
the width of the cutting pattern on the rotary cutter was
35 designed to be narrower than the width of the two-ply
folded sheet; in other words, the two-ply sheet overlaps
the cutting pattern. However, this solution, while

-3-

1 insuring that all pellets are of desired texture and
shape, results in another difficult problem: the
formation of excess scrap material. Unlike cookie,
cracker, or even tortilla chip processes, where the scrap
5 material is easily refed directly into the sheeter, scrap
material in the production of half products can not be
refed directly into the sheeter when forming puffed snack
product of the present invention for a variety of reasons.

Accordingly, it is an object of the present invention
10 to provide novel apparatus and methods for recouping scrap
material remaining after the stamping of the desired
shaped and sized pieces from a continuous dough sheet.

Another object of the present invention is to provide
such novel apparatus and methods which are efficient and
15 commercially feasible.

It is further an object of the present invention to
provide such novel apparatus and methods where the scrap
material is cut into shapes which can be separated from
the desired shaped pieces by using conventional particle
20 separators. It is an aim of the present invention to cut
the scrap material into pieces of a smaller shape than
the desired shaped pieces.

It is further an object of the present invention to
provide such novel apparatus and methods where the first
25 pieces have tessellated shapes which can be cut in a
tight, juxtapositional pattern with no scrap material
between the first pieces. It is further an aim of the
present invention to provide such novel apparatus and
methods where the first pieces have nontessellated shapes,
30 with the scrap material between the first pieces being
stamped by pockets formed in the lands stamping the first
pieces.

It is further an object of the present invention to
provide such novel apparatus and methods where the scrap
35 material is dried in the drying oven with the desired
shaped pieces prior to separation. It is further an aim
of the present invention to grind the dried, scrap

-4-

1 material for refeeding into the dry ingredient mix and
thereby substantially reducing ingredient costs.

SUMMARY

5 Surprisingly, the above objectives can be satisfied
in the field of puffed snack piece fabrication by
providing, in the preferred form, apparatus and methods
of fabricating half products where first and second
pieces of mechanically separable sizes and shapes are
simultaneously stamped from a continuous sheet (which is
10 a folded two-ply sheet in the most preferred form) and
then mechanically separated.

In another aspect of the invention, the first and
second pieces are dried before their mechanical
separation, with the dried first pieces forming the half
15 product and the dried second pieces being ground and
refed back into the process to form the dough formed into
the sheet.

In still other aspects of the invention, pockets are
formed in the land areas between portions of the first
20 cavities having nontessellated shapes which are not in
juxtaposition for stamping the scrap material between the
first pieces reducing the migration of the scrap material
into the first cavities.

The present invention will become clearer in light
25 of the following detailed description of illustrative
embodiments of this invention described in connection
with the drawings.

DESCRIPTION OF THE DRAWINGS

Figure 1 shows a diagrammatic view of the method of
30 forming half products according to the preferred
teachings of the present invention.

Figures 2, 3, and 4 show partial, flat views of a
roller for an apparatus for forming pieces from the dough
sheet according to the preferred teachings of the present
35 invention.

Figure 5 shows a cross-sectional view of the roller
of Figure 4 according to section line 5-5 of Figure 4.

-5-

1 All figures are drawn for ease of explanation of the
basic teachings of the present invention only; the
extensions of the Figures with respect to number,
position, relationship, and dimensions of the parts to
5 form the preferred embodiment will be explained or will
be within the skill of the art after the following
teachings of the present invention have been read and
understood. Further, the exact dimensions and
dimensional proportions to conform to specific force,
10 weight, strength, and similar requirements will likewise
be within the skill of the art after the following
teachings of the present invention have been read and
understood.

Where used in the various figures of the drawings,
15 the same numerals designate the same or similar parts.
Furthermore, when the terms "first", "second", "lower",
"upper", "end", "face", "edge", and similar terms are
used herein, it should be understood that these terms
have reference only to the structure shown in the
20 drawings as it would appear to a person viewing the
drawings and are utilized only to facilitate describing
the invention.

DESCRIPTION

Referring now to the drawings and in particular to
25 Figure 1, an apparatus for flipping and aligning a dough
sheet according to the preferred teachings of the present
invention is generally designated 10 and can be of the
type shown in U.S. Patent Nos. 5,092,757 and 5,217,739.
Particularly, apparatus 10 folds a single continuous
30 dough sheet 12 formed of a cooked farinaceous dough into
a folded, continuous two-ply dough sheet 14. Dough sheet
12 has first and second opposed major faces and two
opposed free edges. Folded dough sheet 14 has two
opposed free edges and outside faces reduced about
35 one-half in area and which are spaced generally twice
the thickness of dough sheet 12.

Folded continuous dough sheet 14 can be provided

-6-

1 by apparatus 10 to a piece forming apparatus or rotary
cutter 16 conveniently constructed having opposed pair
of rollers 18, with at least one of rollers 18 having
cavities or depressions which stamp out the desired shape
5 and size pieces from folded continuous dough sheet 14.
Referring now to Figures 2-4, at least one of rollers
18 of piece forming apparatus 16 includes a first,
central portion 110 extending circumferentially around
roller 18. First portion 110 includes a multiplicity of
10 cavities 112 of the desired shape and size for forming
pieces which in turn are dried to form the half products
or pellets. First portion 110 is located intermediate
the ends of roller 18 and of folded dough sheet 14 and
has a width substantially less than the width of roller
15 18 and of folded dough sheet 14. Additionally, second
and third, boundary portions 114 and 116 extend
circumferentially around roller 18 and include a
multiplicity of cavities 118 of a shape and/or size
substantially different than cavities 112 for forming
20 second pieces which are mechanically separable from the
first pieces. The bottom surfaces of cavities 112 and
118 are concentric to the periphery of roller 18.
Particularly, as dough sheet 14 passes between rollers
18, first and second pieces are stamped from dough sheet
25 14 with the land areas between and forming cavities 112
and 118 cutting dough sheet 14 at the nip between rollers
18. It can then be appreciated that the land areas cut
dough sheet 14 by compressing dough sheet 14 between
rollers 18 which forces the portion of dough sheet 14
30 abutted by the land areas between cavities 112 and 118 to
move or migrate therefrom to an area of non-compression
such as within cavities 112 and 118. This cutting and
migration of dough sheet 114 can be enhanced by beveling
the outer periphery of the land areas to include flat
35 incline surfaces extending approximately one-half the
height of the lands. It can then be appreciated that the
portions remaining in folded dough sheet 14 after the

-7-

1 stamping of the first pieces define the scrap material,
with the second pieces being simultaneously stamped in
the remaining portions as the first pieces are stamped
from folded dough sheet 14.

5 In the preferred form, cavities 118 are generally of
a parallelepiped shape and are of a size substantially
smaller than cavities 112. In the most preferred form,
cavities 118 are arranged in straight rows, with rows of
cavities 118 in Figure 2 being arranged parallel to the
10 axis of roller 18 and in Figures 3 and 4 being arranged
at an acute angle in the order of 20° to the axis of
roller 18. It is believed that the angled nature of the
rows of cavities 118 of Figures 3 and 4 may have reduced
wear over rows of cavities 118 parallel to the roller
15 axis of Figure 2. Portions 114 and 116 extend from the
outside boundaries or edges of portion 110 to the ends of
rollers 18.

Cavities 112 of portion 110 can be of any desired
shape and size. In a preferred form, cavities 112 of
20 portion 110 have tessellated shapes in a generally tight,
juxtapositional pattern. It can then be appreciated that
the land areas between cavities 112 can be minimized
along the entire periphery of cavities 112 and thus
minimize the migration of dough sheet 14 from compressed
25 areas between rollers 18 into cavities 112. Thus, in the
preferred form, the first pieces are stamped from the
central portion of continuous sheet 14 and the remaining
portions of sheet 14 defining the scrap material are
located generally exclusively between the first edges of
30 the central portion and of sheet 14 and between the
second edges of the central portion and of sheet 14.
Examples of tessellated shapes include geometric shapes
such as in the form of isosceles triangles as shown in
the preferred form shown in Figure 2 or in the form of
35 sheaves (i.e. generally bow tie shape) as shown in the
preferred form in Figure 3, as well as squares,
rectangles, or the like.

-8-

1 In other preferred forms, cavities 112 of portion 110
have nontessellated shapes which can not be placed in
juxtapositional patterns. An example of nontessellated
shapes include shapes having arcuate peripheries such as
5 in the form of hearts as shown in the preferred form
shown in Figure 4. As it is desirable to have as many
cavities 112 in portion 110 as possible, cavities 112 are
positioned in a pattern which maximizes the portions of
cavities 112 which are in juxtaposition while minimizing
10 the area between the portions of cavities 112 which are
not in juxtaposition. However, substantial land areas
can exist between the portions of cavities 112 which are
not in juxtaposition. Thus, dough migrating from these
land areas between the portions of cavities 112 can
15 result in an excess of dough material at that point.
This excess of material is observable in the cut pieces
and is also noticeable in the finished product which will
not have consistent size, shape, and appearance which are
preferred by the consumer. One manner of solving this
20 problem would be to space cavities 112 in portion 110 by
cavities for forming scrap pieces which are mechanically
separable from the first pieces and allow the land areas
to be minimized as in tessellated shapes. However, such
a solution would reduce the number of first pieces cut by
25 cavities 112 from dough sheet 14 and the production of
apparatus 16. According to the teachings of the present
invention, this problem is solved by providing a relief
void or pocket 113 in the land areas between the portions
of cavities 112 which are not in juxtaposition. In the
30 most preferred form, pockets 113 are generally pyramid
shaped and extend from the periphery of roller 18 radially
inwardly, with the base at the periphery of roller 18 and
the common vertex at a depth generally equal to 75% of
the depth of cavities 112. It can then be appreciated
35 that the area of roller 18 intermediate cavities 112 and
pockets 113 engaging the other roller 18 (which can be
either of the anvil or cutting type) is minimized to

-9-

1 reduce the amount of dough which is required to migrate,
with dough migrating from the land areas to both cavities
112 and pockets 113. Thus, excess dough material does
not migrate to cavities 112 allowing the cut pieces and
5 finished products to have consistent size, shape, and
appearance.

It should then be further noted that the pyramid
shape of pockets 113 is believed advantageous in the
release of the pieces of dough cut from dough sheet 14 by
10 pockets 113. Particularly, the slanting nature of the
faces of the pyramid shape to a common vertex reduces the
adhesive forces of dough to roller 18 within pockets 113
as would exist if pockets 113 had corners such as when
pockets 113 would be formed by drilling. Additionally,
15 even if the dough is not released from pockets 113, the
dough will have resiliency to allow compression of dough
from dough sheet 14 in later revolutions in pocket 113 to
prevent excess migration of dough into cavities 112 as
long as the dough is not allowed to dry and become hard
20 within pocket 113. It should also be appreciated that
dough cut from dough sheet 14 by pockets 113 are of a
shape and size substantially different than cavities 112
for forming second pieces which are mechanically separable
from the first pieces. Thus, when cavities 112 have
25 nontessellated shapes, the first pieces are stamped from
the central portion of continuous sheet 14, and the
remaining portions of sheet 14 defining the scrap
material are located between the first edges of the
central portion and of sheet 14 and between the second
30 edges of the central portion and of sheet 14 as well as
in the central portion of sheet 14 as cut by pockets 113.

OPERATION OF THE INVENTION

Now that the basic construction of apparatus 10 and
16 according to the preferred teachings of the present
35 invention has been explained, the operation of the
production of the half product according to the preferred
teachings of the present invention can be set forth and

-10-

1 appreciated. Specifically, as diagrammatically shown in
Figure 1, the ingredients 120 for the formation of the
dough are placed into a mixer 122 and thoroughly mixed.
From mixer 122, the mixed ingredients 120 are fed to a
5 cooker extruder 124 which cooks the ingredients 120 into
dough which is extruded for formation into sheet 12.
Sheet 12 is formed by a sheeting apparatus 126. In the
most preferred form, dough sheet 12 is formed into folded
continuous dough sheet 14 by apparatus 10. The first and
10 second free edges are aligned relative to each other in
folded dough sheet 14. Folded dough sheet 14 extends
vertically downward from apparatus 10 into piece forming
apparatus 16 and particularly between rollers 18 thereof.

As folded dough sheet 14 passes through rollers 18,
15 dough sheet 14 is simultaneously stamped into first
pieces having shapes and sizes corresponding to cavities
112 of portion 110 and into second pieces having shapes
and sizes corresponding to pockets 113 and/or cavities
118 of portions 114 and 116. From apparatus 16, the
20 first and second pieces of dough are fed into a drying
oven 134 which reduces the moisture content to between
10% and 15%. From drying oven 134, the dried first and
second pieces are fed to a separator 136 which
mechanically separates the first pieces from the second
25 pieces by utilizing conventional separation techniques.
It can then be appreciated that the separated, dried
first pieces are the half products in the production of
the puffed snack product and can be further processed
at that time or can be placed in storage for later
30 processing at the same or different locations.

The separated, dried, second pieces can be ground by
grinder 138 and added to ingredients 120 prior to or
during the mixing in mixer 122, with ingredients 120 and
the ground second pieces beginning the process again. It
35 should then be appreciated that in the preferred form,
portion 110 has a width such that in the range of 10% to
25% of folded dough sheet 14 results in scrap material

-11-

1 which is cut by cavities 118 of portions 114 and 116 into
the second pieces. This amount of scrap material insures
that the first pieces cut by cavities 112 of portion 110
are all completely formed and possess the desired texture
5 and appearance to create the half product which produces
the finished product preferred by the consumer even with
the normal placement variations in folded dough sheet 14
entering apparatus 16 and without requiring excessive
supervision. It can be appreciated that if the presence
10 of some incompletely formed first pieces is not
detrimental to the marketing of the finished product, the
amount of scrap material can be proportionally reduced
while not exceeding the maximum amount of incompletely
formed first pieces which is tolerated for the particular
15 market. Since the scrap material is reused, the
ingredient costs are substantially reduced especially
considering the excess of scrap material utilized to
insure the uniform production of finished product.

It should then be noted that the production of half
20 products of the type of the present invention involves
problems not encountered in the production of other types
of products. Specifically, in the production of cookies,
crackers, or tortilla chips, the pieces are typically cut
from the dough sheet prior to cooking such that the dough
25 is not at an elevated temperature and can be readily
mixed in with the dough before its entry into the
sheeting device. However, pieces for forming half
products are cut from cooked dough which is hot. It can
then be appreciated that the heated, cooked dough loses
30 moisture after leaving the die of cooker extruder 124.
Thus, even if the cooked dough could somehow be fed back
to the process at or before sheeting apparatus 126, such
refed cooked dough would not have the same consistency as
the freshly cooked dough and would not produce a uniform
35 sheet. Also, when cooked dough cools, the viscosity and
toughness of the cooked dough changes. If mixed with

-12-

1 freshly cooked dough, the dough sheet produced thereby
would not be uniform as desired. Also, cooked dough
which has not been dried is not very stable and will
tend to get moldy or have other undesired effects if not
5 processed in short times.

Additionally, cooked, nondried dough is very sticky
and difficult to handle. Thus, it is very difficult to
feed cooked, nondried dough to cooker extruder 124 at an
even, controlled rate. Likewise, the cooked, nondried
10 dough will often clog together. Additionally, the dough
is typically pneumatically transferred to drying oven 134.
However, sheets or strips (with the first pieces removed)
or large chunks of dough can not be transferred
pneumatically due to the tendency of plugging. Further,
15 even if transferable to drying oven 134, such sheets,
strips, or large chunks of dough would adversely affect
the operation and efficiency of drying the first pieces
to form the half product. Thus, the formation of the
smaller, second pieces allows for ease of handling such
20 as the pneumatic transfer with the first pieces to drying
oven 134, with the second pieces being dried with the
first pieces in drying oven 134 without detrimentally
affecting the operation and efficiency of drying oven
134. After drying, the second pieces can be easily and
25 accurately handled (including their separation from the
first pieces) and are extremely stable allowing either
their immediate or later further processing according to
the teachings of the present invention.

The present apparatus thus is particularly useful in
30 connection with the continuous, high production capacity
manufacture of two-ply laminated snack half products.
However, the teachings of the present invention may be
applicable to other environments where recouping of scrap
material during the formation of first pieces from a
35 continuous sheet and like advantages are desired.

-13-

1 Thus since the invention disclosed herein may be
embodied in other specific forms without departing from
the spirit or general characteristics thereof, some of
which forms have been indicated, the embodiments
5 described herein are to be considered in all respects
illustrative and not restrictive. The scope of the
invention is to be indicated by the appended claims,
rather than by the foregoing description, and all changes
which come within the meaning and range of equivalency of
10 the claims are intended to be embraced therein.

What is claimed is:

-14-

1. Method for recouping scrap material during the formation of first pieces from a continuous sheet, with the sheet having first and second side edges, comprising the steps of: stamping the first pieces from the continuous sheet intermediate the first and second edges of the continuous sheet with the portions remaining in the continuous sheet defining the scrap material; simultaneously stamping the remaining portions of the continuous sheet into second pieces of a size and shape mechanically separable from the first pieces; and mechanically separating the first pieces from the second pieces.

2. The method of claim 1 wherein the simultaneously stamping step comprises the step of simultaneously stamping the remaining portions of the continuous sheet into second pieces of a different size than that of the first pieces.

3. The method of claim 2 wherein the simultaneously stamping step comprises the step of simultaneously stamping the remaining portions of the continuous sheet into second pieces of a smaller size than that of the first pieces.

4. The method of claim 3 wherein the simultaneously stamping step comprises the step of simultaneously stamping the remaining portions of the continuous sheet into second pieces of a different shape than that of the first pieces.

5. The method of claim 1 wherein the simultaneously stamping step comprises the step of simultaneously stamping the remaining portions of the continuous sheet into second pieces of a different shape than that of the first pieces.

6. The method of claim 1 wherein the continuous sheet has a moisture content, and wherein the method further comprises the step of drying the first and second pieces to reduce their moisture content before the mechanically separating step.

7. The method of claim 6 further comprising the step of grinding the second pieces after the mechanically separating step.

8. The method of claim 1 wherein the stamping step comprises the step of stamping the first pieces from a central portion of the continuous sheet, with the central

-15-

portion having a first edge spaced from the first edge of the continuous sheet and a second edge spaced from the second edge of the continuous sheet, with the remaining portions of the continuous sheet located generally exclusively between the first edges of the central portion and of the continuous sheet and between the second edges of the central portion and of the continuous sheet.

9. The method of claim 1 wherein the stamping step comprises the step of stamping the first pieces of nontesselating shapes, with the remaining portions located between the first pieces.

10. The method of claim 9 wherein the stamping step comprises the step of stamping the first pieces from a central portion of the continuous sheet, with the central portion having a first edge spaced from the first edge of the continuous sheet and a second edge spaced from the second edge of the continuous sheet, with the remaining portions of the continuous sheet also located between the first edges of the central portion and of the continuous sheet and between the second edges of the central portion and of the continuous sheet.

11. The method of claim 1 wherein the stamping and simultaneous stamping steps comprise the step of rolling at least one roller past the continuous sheet, with the roller having first and second cavities, with the first cavities stamping the first pieces from the continuous sheet intermediate the first and second edges of the continuous sheet with the portions remaining in the continuous sheet defining the scrap material, with the second cavities simultaneously stamping the remaining portions of the continuous sheet into second pieces of a size and shape mechanically separable from the first pieces.

12. The method of claim 11 wherein the stamping step comprises the step of stamping the first pieces of nontesselating shapes; and wherein the step of rolling at least one roller comprises the step of rolling at least one roller having a central portion extending circumferentially around the roller and located intermediate the ends of the

-16-

roller, with the first cavities exclusively located in the central portion and the second cavities located exclusively on the opposite sides of the central portion, with the roller having pockets located in the central portion intermediate the first cavities for simultaneously stamping the remaining portions of the continuous sheet into the second pieces of a size smaller than and mechanically separable from the first pieces.

13. Method for forming a half product for producing a puffed product comprising the steps of: mixing the ingredients to form a dough; cooking the dough; sheeting the cooked dough into a continuous sheet having first and second side edges; stamping the first pieces from the continuous sheet intermediate the first and second edges of the continuous sheet, with the portions remaining in the continuous sheet defining scrap material; simultaneously stamping the remaining portions of the continuous sheet into second pieces of a size and shape mechanically separable from the first pieces; drying the first and second pieces to reduce their moisture content; mechanically separating the dried first pieces from the dried second pieces; grinding the separated dried second pieces; and adding the ground second pieces to the ingredients prior to or during the mixing step.

14. The method of claim 13 further comprising the step of flipping and aligning the continuous sheet into a folded continuous two-ply sheet prior to the stamping steps.

15. The method of claim 14 wherein the stamping step comprises the step of stamping the first pieces from a central portion of the continuous sheet, with the central portion having a first edge spaced from the first edge of the continuous sheet and a second edge spaced from the second edge of the continuous sheet, with the remaining portions of the continuous sheet located generally exclusively between the first edges of the central portion and of the continuous sheet and between the second edges of the central portion and of the continuous sheet.

16. The method of claim 14 wherein the simultaneously

-17-

stamping step comprises the step of simultaneously stamping the remaining portions of the continuous sheet into second pieces of a smaller size than that of the first pieces.

17. The method of claim 14 wherein the simultaneously stamping step comprises the step of simultaneously stamping the remaining portions of the continuous sheet into second pieces of a different shape than that of the first pieces.

18. The method of claim 13 wherein the stamping step comprises the step of stamping the first pieces of nontessellating shapes, with the remaining portions located between the first pieces.

19. The method of claim 18 wherein the stamping step comprises the step of stamping the first pieces from a central portion of the continuous sheet, with the central portion having a first edge spaced from the first edge of the continuous sheet and a second edge spaced from the second edge of the continuous sheet, with the remaining portions of the continuous sheet also located between the first edges of the central portion and of the continuous sheet and between the second edges of the central portion and of the continuous sheet.

20. The method of claim 13 wherein the stamping and simultaneous stamping steps comprise the step of rolling at least one roller past the continuous sheet, with the roller having first and second cavities, with the first cavities stamping the first pieces from the continuous sheet intermediate the first and second edges of the continuous sheet with the portions remaining in the continuous sheet defining the scrap material, with the second cavities simultaneously stamping the remaining portions of the continuous sheet into second pieces of a size and shape mechanically separable from the first pieces.

21. The method of claim 20 wherein the stamping step comprises the step of stamping the first pieces of nontessellating shapes; and wherein the step of rolling at least one roller comprises the step of rolling at least one roller having a central portion extending circumferentially around the roller and located intermediate the ends of the

-18-

roller, with the first cavities exclusively located in the central portion and the second cavities located exclusively on the opposite sides of the central portion, with the roller having pockets located in the central portion intermediate the first cavities for simultaneously stamping the remaining portions of the continuous sheet into the second pieces of a size smaller than and mechanically separable from the first pieces.

22. Apparatus for recouping scrap material during the formation of first pieces from a continuous sheet, with the sheet having first and second side edges, comprising, in combination: a piece forming apparatus including at least one roller, with the roller having first and second cavities, with the first cavities stamping the first pieces from the continuous sheet intermediate the first and second edges of the continuous sheet with the portions remaining in the continuous sheet defining the scrap material, with the second cavities simultaneously stamping the remaining portions of the continuous sheet into second pieces of a size and shape mechanically separable from the first pieces; and means for mechanically separating the first pieces from the second pieces.

23. The apparatus of claim 22 wherein the second pieces have a different size than the first pieces.

24. The apparatus of claim 23 wherein the second pieces have a different shape than the first pieces.

25. The apparatus of claim 23 wherein the second pieces are smaller than the first pieces.

26. The apparatus of claim 22 further comprising, in combination: means for simultaneously drying the first and second pieces; and means for grinding the dried second pieces.

27. The apparatus of claim 22 wherein the first cavities are located in a central, circumferential portion of the roller; and wherein the second cavities are located exclusively in first and second, circumferential boundary portions of the roller located outside of and on opposite sides of the central portion.

-19-

28. The apparatus of claim 22 wherein the second pieces have a different shape than the first pieces.

29. The apparatus of claim 22 wherein the first pieces have nontessellating shapes.

30. The apparatus of claim 29 wherein the roller has a central portion extending circumferentially around the roller and located intermediate the ends of the roller, with the first cavities exclusively located in the central portion and the second cavities located exclusively on the opposite sides of the central portion.

31. Apparatus for formation of first pieces from a continuous sheet, with the sheet having first and second side edges, comprising, in combination: a piece forming apparatus including at least one roller having a periphery; first cavities having the shape of the first pieces extending from the periphery of the roller radially inwardly; lands located between the first cavities defining the cavities for stamping the first pieces from the continuous sheet, with the portions remaining in the continuous sheet between the first pieces defining scrap material, with at least first areas of the lands at the periphery being defined between the portions of the cavities which are in juxtaposition and second areas of the lands at the periphery being defined between the portions of the cavities which are not in juxtaposition, with the second areas being substantially larger than the first areas; and pockets formed in the second areas extending from the periphery of the roller radially inwardly, with the pockets simultaneously stamping the scrap material of the continuous sheet between the first pieces into second pieces of a size smaller than and mechanically separable from the first pieces, with the simultaneous stamping of the second pieces by the pockets reducing migration of the scrap material into the first cavities while the lands stamp the first pieces from the continuous sheet.

32. The apparatus of claim 31 wherein each of the pockets extend from the periphery to a common vertex.

33. The apparatus of claim 32 wherein the pockets are

-20-

pyramid shaped.

34. The apparatus of claim 33 wherein the common vertex has a depth from the periphery less than the depth of the first cavities from the periphery.

35. The apparatus of claim 34 wherein the first cavities have a bottom surface concentric to the periphery of the roller.

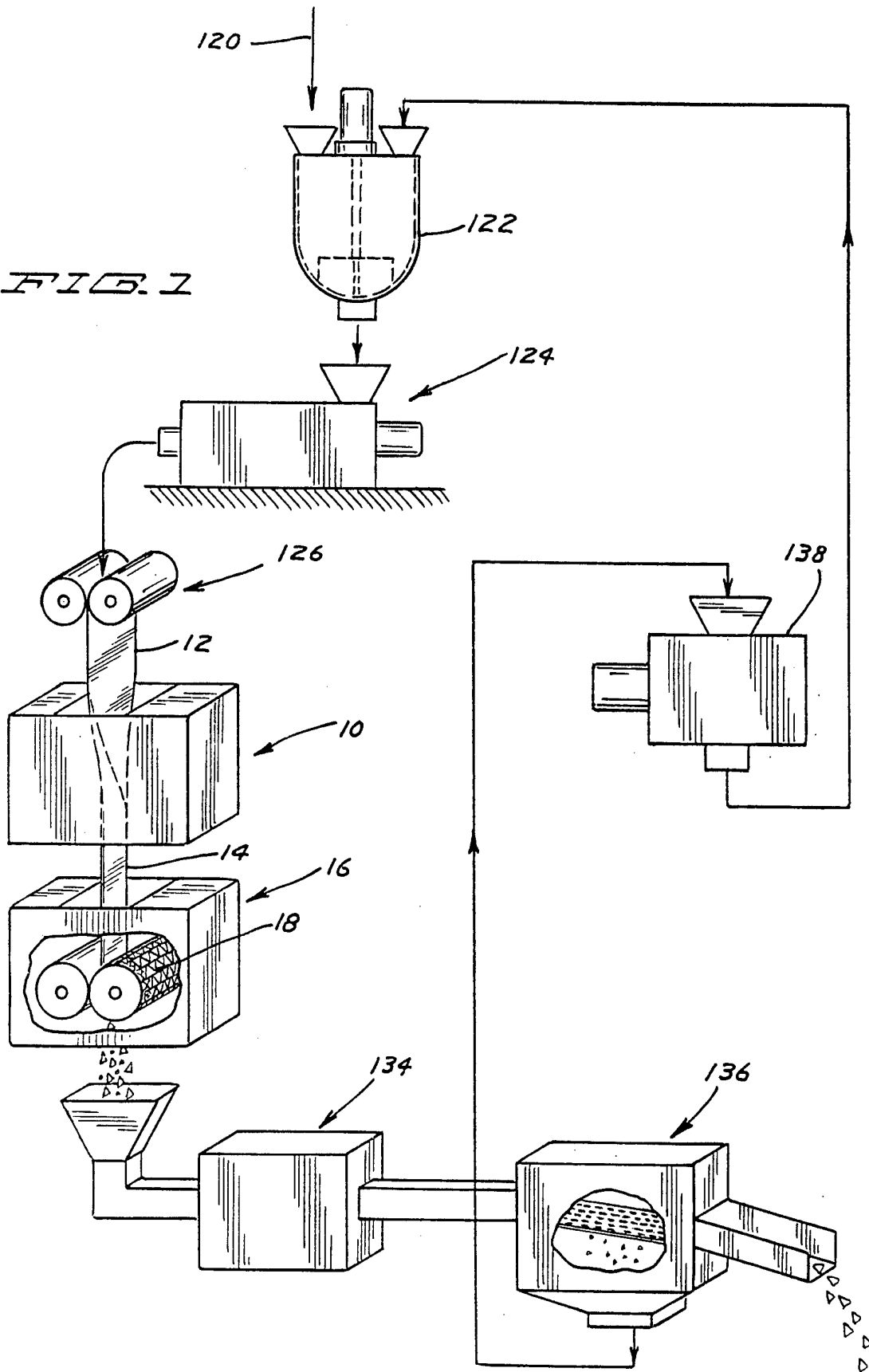
36. The apparatus of claim 35 wherein the land areas are beveled at the periphery inside of the cavities.

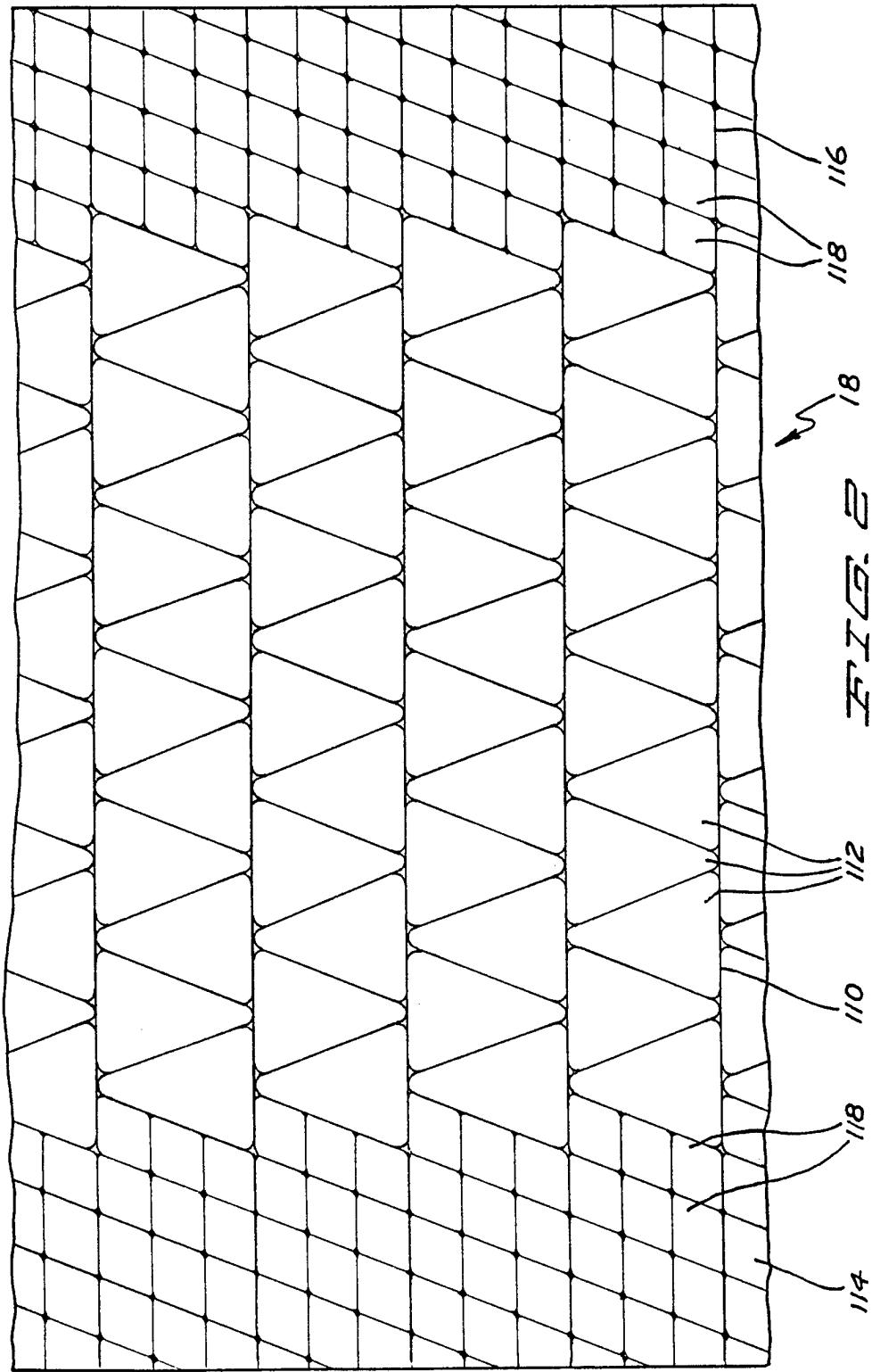
37. The apparatus of claim 32 wherein the common vertex has a depth from the periphery less than the depth of the first cavities from the periphery.

38. The apparatus of claim 31 wherein the roller has second cavities for stamping the second pieces from the continuous sheet, with the roller having a central portion extending circumferentially around the roller and located intermediate the ends of the roller, with the first cavities exclusively located in the central portion and the second cavities located exclusively on the opposite sides of the central portion, with the pockets located in the central portion intermediate the first cavities.

1/4

FIG. 1





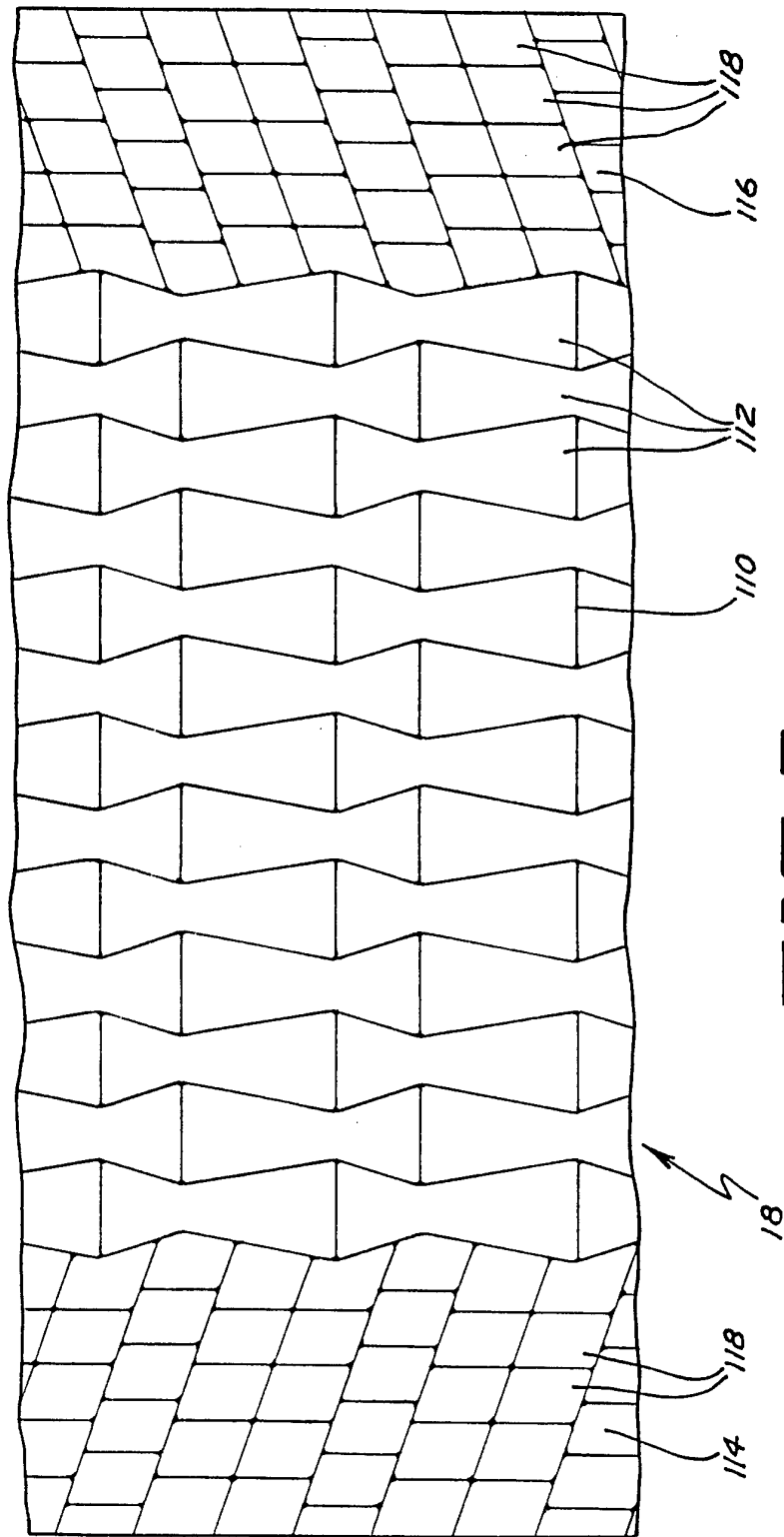
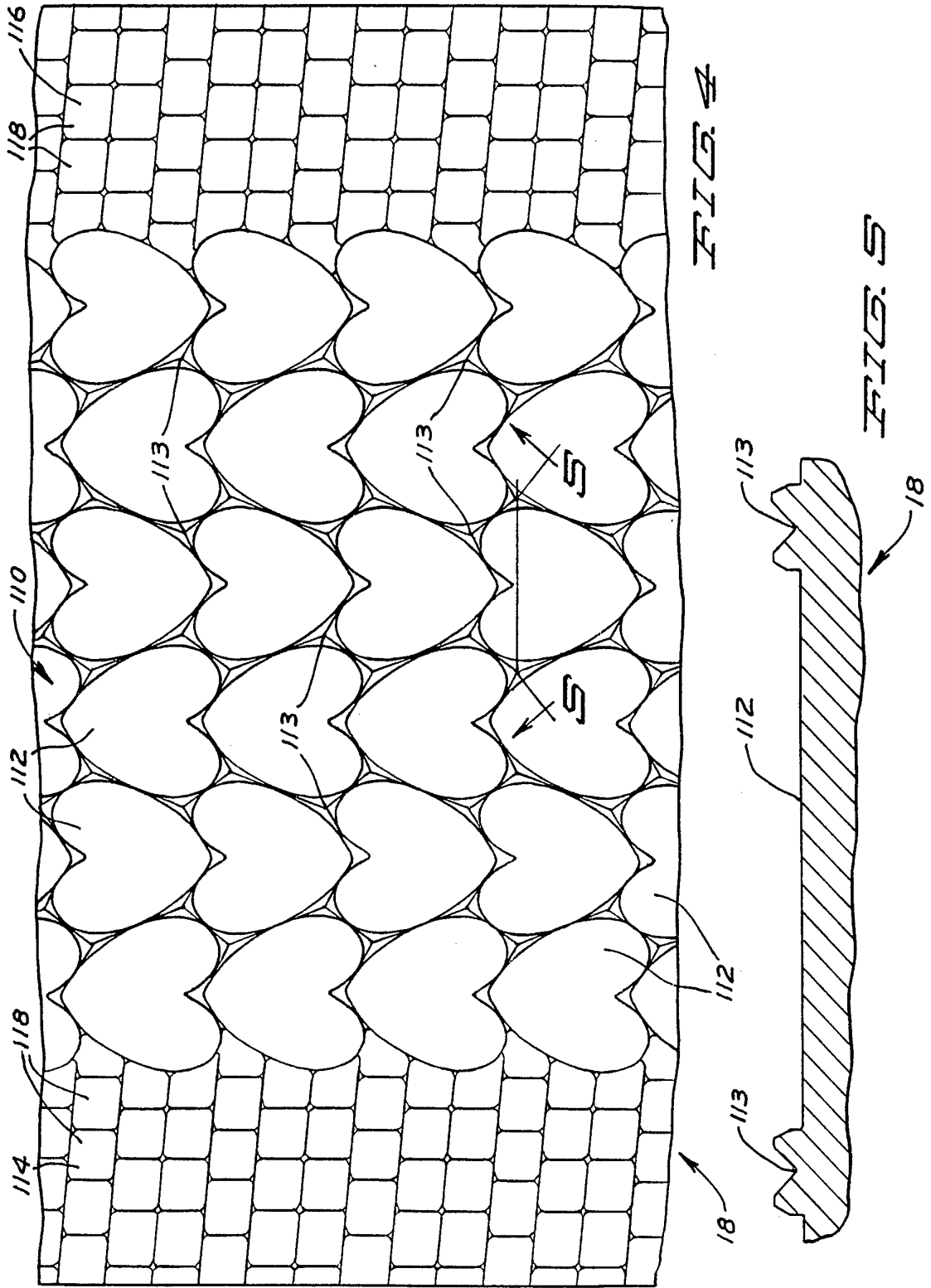


FIG. 3



INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 93/05937

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 5 A21C11/02 A21C11/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 5 A21C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP,A,0 452 982 (M.J. WILLARD) 23 October 1991 see the whole document ---	1-38
X	EP,A,0 377 161 (A. FRITSCH GMBH & CO) 11 July 1990 see the whole document ---	1-38
A	CA,A,1 016 011 (J.P. HALE ET AL) 23 August 1977 see claims ---	1-38
A	US,A,4 350 251 (FRITO-LAY INC) 21 September 1982 see the whole document ---	1-38
A	US,A,3 880 069 (R.V. MOLINE) 29 April 1975 ---	
	-/--	

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

8 October 1993

Date of mailing of the international search report

18. 10. 93

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
 NL - 2280 HV Rijswijk
 Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl,
 Fax (+ 31-70) 340-3016

Authorized officer

FRANKS, N

INTERNATIONAL SEARCH REPORT

Inter. nal Application No
PCT/US 93/05937

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,4 075 359 (R.R. THULIN) 21 February 1978	

A	WO,A,91 05483 (UNITED BISCUITS (UK) LTD.) 2 May 1991	

A	US,A,4 108 033 (W.E. BEMBENEK) 22 August 1978	

1

INTERNATIONAL SEARCH REPORT

information on patent family members

International Application No

PCT/US 93/05937

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A-0452982	23-10-91	US-A- 4650687	17-03-87
		AU-B- 571367	14-04-88
		AU-A- 5341986	21-08-86
		CA-A- 1292138	19-11-91
		DE-A- 3685237	17-06-92
		EP-A, B 0193027	03-09-86
		JP-A- 61209566	17-09-86
		US-A- 4889737	26-12-89
		US-A- 4889733	26-12-89
EP-A-0377161	11-07-90	DE-C- 3844440	29-03-90
CA-A-1016011	23-08-77	NONE	
US-A-4350251	21-09-82	US-A- 4224350	23-09-80
US-A-3880069	29-04-75	CA-A- 998880	26-10-76
		CA-A- 999019	26-10-76
		US-A- 4046920	06-09-77
US-A-4075359	21-02-78	NONE	
WO-A-9105483	02-05-91	GB-A- 2237719	15-05-91
		EP-A- 0496767	05-08-92
US-A-4108033	22-08-78	NONE	