

PHILIPPINE PATENT (19)

[11] No.: 26871  
[45] Issued: NOV 16 1992

- [54] Title: DISPOSABLE DIAPER
- [75] Inventor (s): TAKAMITSU IGAUE, HIROYUKI TANJI, both of Ihome-ken;  
HIDEAKI KITAOKA, of Chiba-ken, all of Japan
- [73] Assignee (s): UNI-CHARM CORPORATION, of Ehime-ken, Japan, a  
corporation of Japan
- [22] Filed: March 30, 1987
- [21] Application Serial No: 35088

FOREIGN APPLICATION PRIORITY DATA

- [31] Number (s) : 61-75767 and 61-304437
- [32] Date (s) : March 31, 1986 and December 20, 1986
- [33] Country (ies) : Japan
- [52] PH Class ..... 604/385A
- [51] Int. Class ..... A41B 13/02
- [58] Field of Search ..... 604/385A
- [56] Reference (s) Cited and/or Considered:

Phil. Pat. Nos. 16555	11/1983	Masek et al.
20442	1/1987	Enloo

[57]

ABSTRACT see attached sheet

26871

Mr. [illegible]  
[Handwritten signature]

DISPOSABLE DIAPER

ABSTRACT OF THE DISCLOSURE

A disposable diaper includes a semi-rigid absorbent body and high flexible side flaps disposed on laterally opposite side thereof. Each of said side flaps includes a first flap disposed outside said absorbent body and a second flap diverged from said first side flap. Each of said second flaps has the associated one of an elastic band incorporated therein and turned up under an elastic effect of said associated elastic band at least along a line of the divergence.

## DISPOSABLE DIAPER

### BACKGROUND OF THE INVENTION

The present invention relates to a disposable diaper adapted to absorb and retain human excretions and more particularly to such disposable diaper to be worn by babies, sick persons, aged people and persons suffering from incontinence, in which a selected portion of each flexible side flap incorporated with elastic band is turned upwards under an elastic effect of said elastic band.

Some of the absorptive articles such as disposable diaper have already adopted the side flaps constructed to be raised so that a fitness of said side flaps around the thighs of the wearer is improved and thereby leakage of excretions which would otherwise occur across the thighs can be effectively avoided, for example, as disclosed in U.S. Patent No. 4,579,556. In accordance with the technique as disclosed by this U.S. Patent, along the outer edges of the rectangular absorbent body (layer) interposed between or sandwiched by the topsheet and the backsheet, the side flaps rise under elastic effect of the elastic bands which are incorporated into the respective side flaps along the outer edges thereof. Such rising or turning up of the side flaps is believed to occur due to a fact that a

rigidity of the absorbent body is higher than that of the side flaps and, in consequence, the elastic effect of the elastic bands transmitted to said side flaps is blocked by the outer edges of said absorbent body and converted into an effect serving to turn said side flaps up.

According to this concept, however, the absorbent body is restricted to a configuration having the substantially linear outer edges, i.e., the rectangular form in general and its width is also restricted, so that it is difficult for the absorbent body to be configured in any other shape suitable to improve a fitness of the diaper around the wearer's body, for example, in the form of a sandglass. In addition, although the side flaps are certainly turned up as has been described above, such rising or turning up is merely bending of the side flaps along the outer edges of the absorbent body. Accordingly, said side flaps might be subjected to a stress-strain due to the rigidity of said absorbent body and thereby their free flexibility might tend to be hindered, unless the height (width) of said flaps is dimensioned to be relatively large and distances between the elastic gathers formed by the associated elastic bands mounted on the free ends of the respective side flaps and the associated outer edges of said absorbent body are also dimensioned to be relatively large. At the same time,

said absorbent body tends to be subjected to a stress-strain due to the elastic effect of said elastic bands and thereby to be irregularly deformed, resulting in various inconveniences such as deteriorated appearance  
5 of the diaper as being worn, an uncomfortability for the wearer and a poor fitness of the diaper on the wearer's body, particularly a poor sealing effect around the thighs.

A typical technique to overcome the problems  
10 encountered when the side flaps including the elastic gathers formed by the elastic bands are associated with combining with a semi-rigid absorbent body is disclosed in the U.S. Patent No. 3,860,003. The technique disclosed in this U.S. Patent teaches that, when the  
15 side flaps are incorporated with the elastic bands along the outer sides thereof sufficiently spaced from the associated outer edges of the absorbent body, an effective seal is obtained around the thighs without significantly hindered contractibility and flexibility  
20 of the side flaps by said elastic bands due to the rigidity of said absorbent body.

However, when the elastic bands are to be disposed along the outer sides of the side flaps sufficiently spaced from the associated outer edges of the absorbent  
25 body, it will be necessary that the width of the absorbent body is dimensioned to be relatively narrow at least in the crotch area. This will result in that

a capacity or a volume to absorb and retain excretions is reduced in the most important area for this purpose and thereby leakage of excretions occurs across around the thighs. Although the U.S. Patent No. 3,860,003  
5 intends to eliminate the drawback of the prior art that the front portion of the diaper is encouraged to blossom or pouch outwards as though it were trying to form a damp apron, this intention will be not achieved when the respective elastic bands are sufficiently  
10 spaced from the associated outer edges of the absorbent body.

Thus, the prior art anticipates no measure to overcome the above-mentioned problems which are effectively solved, according to the present invention,  
15 by a particular arrangement of the side flaps as will be described in detail later.

A principal object of the present invention is, for the purpose of effectively overcoming the inconveniences as set forth above, to provide a disposable  
20 diaper so improved to achieve an effective seal around the thighs as can not be expected from the prior art and thereby to minimize a possible leakage of excretions across around the thighs.

Other objects and advantages of the present  
25 invention will be apparent from reading the following description.

## SUMMARY OF THE INVENTION

The present invention broadly resides in a disposable diaper including a liquid-permeable topsheet, a liquid-impermeable backsheet, an absorbent  
5 body interposed between said both sheets and having a semi-rigidity, liquid-impermeable side flaps disposed on laterally opposite sides of said absorbent body and having a high flexibility, elastic bands adapted to form elastic gathers extending longitudinally of said  
10 flaps and tape fasteners disposed on laterally opposite sides in a rear side area of the diaper, wherein each of said side flaps includes a first flap disposed outside said absorbent body and a second flap diverged from said first side flap, having the associated one of  
15 said elastic bands incorporated therein and turned up under an elastic effect of said associated elastic band at least along a line of the divergence.

With such arrangement of the present invention, said second flap is turned up from said line of  
20 divergence transversely of said first flap so that the gather portion of said second flap functions to achieve a desired effect independently of the rigidity of said absorbent body even if a distance from the outer edge of said absorbent body to said elastic band is  
25 relatively small.

# BRIEF DESCRIPTION OF THE DRAWING

Fig. 1 is a perspective view showing a diaper constructed in accordance with the present invention as completely assembled;

5        Fig. 2 is a developed perspective view showing a top side of said diaper;

Fig. 3 is a sectional view taken along a line 3-3 in Fig. 2.

10       Fig. 4 is a sectional view taken along a line 4-4 in Fig. 2;

Fig. 5 is a sectional view taken along a line 5-5 in Fig. 2;

Fig. 6 is a partial perspective view showing a side portion of said diaper;

15       Fig. 7 is a plan view showing said diaper as in a process of its formation;

Fig. 8 is a plan view showing said diaper as having been completed after said process of formation;

20       Fig. 9 is a developed plan view showing said diaper as having been longitudinally extended;

Fig. 10 through 17 are partial perspective views showing other embodiments of said side portion; and

Fig. 18 is an enlarged schematic sectional view taken along a line 18-18 in Fig. 9.



## PREFERRED EMBODIMENTS OF THE INVENTION

Referring to Figs. 1 through 6, a diaper of the invention comprises a liquid-permeable topsheet 11, a liquid-impermeable backsheet 12, a semi-rigid absorbent body 13 and side flaps 14. Each of said side flaps 14 consists of a first flap 16 and a second flap 17. The first flap 16 consists, in turn, of respective portions of the topsheet 11 and the backsheet 12 as well as a portion of the second flap 17 which extend outwards from each side edge of the absorbent body 13. The width of said extending portions of the topsheet 11 may be smaller than that of the backsheet 12. The second flap 17 lies upon the top surface of the first flap 16 and outside portions of these both flaps lying one upon another are so joined to each other as to define a pocket 28 therebetween. An inside portion of the second flap 17 which is not joined to the first flap 16 is turned or folded upwardly and a portion 17a thus turned or folded up is then securely joined to itself at a front side area 19 and a rear side area 20 of the diaper. A folded portion of the second flap 17 located in a crotch area defined between said front side area 19 and said rear side area 20 is provided along its free end with elastic band 22 fixed thereon under its longitudinally stretched condition with adhesive (not shown) of hot melt type and enclosed by an envelope-

like edge 23 of the second flap 17. The first flap 16 is formed along its outer edge with a cut-away portion 24.

Such diaper is obtained, as seen in Figs. 7 through 9, by sandwiching the absorbent body 13 between the rectangular topsheet 11 and the rectangular backsheet 12, disposing a pair of narrow rectangular flap sheets 17 which have previously been provided with elastic bands 22 along laterally opposite sides of the topsheet 11 (see Fig. 6), joining these to said topsheet 11 with adhesive of hot melt type or any other suitable welding means (not shown) over areas indicated by two-dotted chain lines (oblique lines), then partially cutting away the sheets 11, 12 and 17, folding the inside portion of the sheet 17 back and finally fixedly joining the portion 17a thus folded back to itself in the front side area and the rear side area thereof also by use of adhesive of hot melt type or any other suitable welding means (not shown). As seen in Figs. 2 and 9, a transverse distance between the pair of said folded portions 17a is larger in the rear side area 20 than in the front side area 19 of the diaper. Thus, the rear side area 20 corresponding to hip of the wearer and primarily exposed to excretions is wider than the front side area 19.

In the rear side area 20, the respective side flaps 14 is provided with tape fasteners 27 carrying

thereon pressure sensitive adhesive and, upon actually wearing, the diaper is assembled, as seen in Fig. 1, by securing free ends of the respective fasteners onto the front side of the diaper.

5        The topsheet 11 may be of fibrous nonwoven fabric, porous plastic film etc., and the backsheet 12 may be of plastic film, laminate sheet consisting of said plastic film and fibrous nonwoven fabric etc.. When said laminate sheet is employed, this is used with said  
10 nonwoven fabric facing outwards. Although said plastic film is preferably air-permeable and liquid proof, the air-permeability will be unnecessary if there is provided means to assist ventilation through the diaper between inside and outside thereof. The absorbent body  
15 13 may be, for example, of mat-like body consisting of fluff pulp mixed or not mixed with high-absorptivity polymer particles, covered at least on upper and lower sides with liquid-permeable sheets such as tissue paper and hydrophobic nets. In view of such material and  
20 configuration, it will be obviously understood that the absorbent body 13 is semi-rigid. The absorbent body 13 is securely joined to both the topsheet 11 and the backsheet 12 in a relatively stationary manner as with adhesive of hot melt type (not shown). The elastic  
25 bands 22 may be thread or tape-like rubber, tape-like plastic foam or plastic film exhibiting an elasticity when heat-treated. These materials used to manufacture

the diaper are those commonly used for the disposable diaper and those skilled in the art will easily make a choice as desired.

5       The first flap 16 is, as has previously been mentioned, formed by the respective portions of the topsheet 11 and the backsheet 12 extending outwards from each of the laterally opposite edges of the absorbent body 13 and a portion of the second flap 17. The second flap 17 is made of an air-permeable and  
10   liquid-proof sheet, preferably of fibrous nonwoven fabric which has been subjected to liquid-proofing with silicone resin.

      In an embodiment as shown by Figs. 8 and 9, lugs 28 laterally projecting from the front side area at  
15   opposite sides have their dimensions different from lugs 29 similarly projecting from the rear side area of the diaper, and the absorbent body 13 has lugs 30 only in the rear side area. However, the present invention is not limited to such configuration.

20       The side flaps 14 may be formed, as in an embodiment shown in Figs. 10 and 11, by folding back the outside portion(s) of both the wide topsheet 11 and the wide backsheet 12 or of only the backsheet 12. However, when said separate sheet 17 different in  
25   nature from both the topsheet 11 and the backsheet 12 is used to form the side flaps 14, various advantages are obtained, which can not be expected when the side

flaps 14 are formed by the extensions of the topsheet 11 and the backsheet 12. For example, when the backsheet 12 is of air-permeable and liquid-proof material, the side flaps 14 may be formed by highly  
5 air-permeable and liquid-proof material to further reduce a stiffness possibly occurring inside the diaper. Furthermore, even if such highly air-permeable and liquid-proof material is of a relatively high cost, this leads to no economical disadvantage, because the  
10 side flaps 14, particularly the second flaps 17 may be narrow relative to the backsheet 12.


In an embodiment as shown by Fig. 12, each of the second flaps 17 is formed by sandwiching its longitudinal one side between the respective portions  
15 of the topsheet 11 and the backsheet 12 which together form the associated first flap 16, folding back this onto said portion of the topsheet 11 and joined thereonto, then turning or folding a remaining or non-joined side outwards, joining the portion 17a thus  
20 turned or folded outwards onto itself along longitudinal opposite ends of this portion, and finally providing the non-joined folded portion with the associated elastic band 22.

Each of the second flaps 17 in an embodiment as  
25 shown by Fig. 13 is formed by joining its longitudinal one side onto the upper side of the associated first flap 16 at a position inside the side edge of the

associated first flap 16, turning or folding a remaining or non-joined side outwards, joining the portion 17a thus turned or folded outwards onto itself along longitudinal opposite ends of this portion, and finally providing a free end of the non-joined folded portion with the associated elastic band 22.


In an embodiment as shown by Fig. 14, each of the second flaps 17 is formed by laying it on the upper side of the associated first flap 16, joining it thereonto, turning or folding a remaining or non-joined portion outwards, joining the portion thus turned or folded outwards onto itself along longitudinal opposite ends of this portion and finally providing a non-joined central portion with the associated elastic band 22.

In an embodiment of Fig. 15, the second flap 17 is formed by bending the respective extensions of the topsheet 11 and the backsheet 12 upwardly in a

-shape, inserting the associated elastic band 22 into a space defined inside a top of this bent portion and joining the inner surface of this portion together.

The second flap 17 in an embodiment as shown by Fig. 16 is formed by bending the extensions of the topsheet 11 upwards, joining one side of a sheet 31 onto the upper side of the backsheet 12 along an outer side portion of the extension thereof, joining the other side of said sheet 31 onto said bent portion of the topsheet 11 in symmetrical relationship therewith

and inserting the associated elastic band 22 into a space defined between the top ends of these bent portions.

In an embodiment as shown by Fig. 17, the second flap 17 is formed by joining lower ends of a sheet 32 bend in a -shape onto the extension of the topsheet 11 and inserting the associated elastic band 22 into a space defined inside a top of this bent portion.

The second flap 17 in the embodiment of Figs. 15 through 18 is preferably laid outwards and fixedly joined along longitudinal opposite ends thereof for the reason as will be mentioned. However, the present invention is not limited to such arrangement. In all the embodiments as shown, a portion 33 extending outwards from the second flap 17 in the crotch area has no contribution to provide seals around the thighs and therefore may be omitted except when this is necessary to form the pockets 18.

The diaper constructed in the manner as has been mentioned hereinabove in accordance with the present invention provides advantages as will be set forth below.

When the pockets 18 are formed, excretions flowing towards the side flaps 14 is retained by these pockets and effectively prevented from leaking across around the thighs.

The respective elastic bands 22 give the

associated second flaps 17 effective elasticity and  
create the gathers. Contracting force of the elastic  
bands 22 act substantially upon overall of the  
associated second flaps 17, but such contracting force  
5 is reduced or suppressed on the lines 34 along which  
the respective second flaps 17 diverge from the  
associated first flaps 16, resulting in that a portion  
(major portion) of said contracting force is converted  
into an effect serving to turn the associated second  
10 flaps 17 up from the associated first flaps 16 along  
said lines 34 of divergence and thus the second flaps  
17 are turned or folded up independently of the outer  
edges of the absorbent body 13. In the case in which  
the folding lines 35 of the respective folded portions  
15 17a are distinctly formed independently of said lines  
34 of divergence as seen in Figs. 4 and 6, the  
contracting force of the respective elastic bands 22 is  
reduced or suppressed also along these folding lines  
35. With a consequence, even when the distance  
20 between each elastic band 22 and the associated outer  
edge of the absorbent body 13 is relatively small, the  
problems that the second flaps 17 under the contracting  
force of the associated elastic bands 22 might have  
their contractibility and flexibility affected by the  
25 rigidity of the absorbent body 13 as well as the  
problems that the first flaps 16 and the absorbent body  
13 might be subjected to a unnatural stress-strain due



to the contracting force of the respective elastic  
bands 22 are effectively solved. Accordingly,  
indecent appearance of the diaper as worn and uncom-  
fortability for the wearer are avoided and a suffi-  
5 cient fitness of the diaper around the wearer's body,  
particularly an effective seal around the thighs are  
achieved, minimizing leakage of excretions.

The second flaps 17 have their free ends along  
which the elastic bands 22 are disposed directed  
10 outwardly and their longitudinal opposite ends being  
fixed against the elastic effect of the elastic bands  
22 tending to lay down the second flaps 17 inwardly,  
the second flaps 17 are normally biased under a tension  
enough to maintain the second flaps 17 folded upwards  
15 and thereby prevented from being folded or turned  
inwardly when the diaper is worn. Moreover, movement  
of the wearer's thighs causes the second flaps 17 to be  
inclined or pivoted on said fixed longitudinal opposite  
ends and said lines 34 of divergence so as to keep  
20 resilient contact with the wearer's skin without  
formation of a gap causing leakage of excretions across  
around the thighs.

In view of the construction and the function as  
mentioned above, said lines 34 of divergence can be  
25 considered as rigidity gap lines or discontinuous  
rigidity lines which prevent the contracting force of  
the respective elastic band 22 from being transmitted

beyond the second flap 17 to the first flap 16. To improve the contracting force of the elastic bands 22 and the contractibility of the second flaps 17, a height of each second flap 17 should be at least 10mm, preferably 15 to 50mm. Distance between the outer edge of the absorbent body 13 and said line 34 of divergence is not critical, but preferably less than 50 mm. The second flaps 17 may be close to the outer edges of the absorbent body 13 so far as the second flaps 17 have a desired height and said rigidity gap lines or discontinuous rigidity lines are formed.

Although not critical to solve the objects of the present invention, waist flaps 36 are formed by the respective portions of the topsheet 11 and the backsheet 12 extending outwards from the longitudinal opposite ends of the absorbent body 13, as seen in Figs. 2, 3, 5 and 7 through 9, and 18. Second elastic bands 37 are disposed under longitudinal tension in a sandwich manner between the waist flaps 36, i.e., between the topsheet 11 and the backsheet 12. These elastic bands 37 are of plastic foam, particularly of polyurethane foam preferably having a thickness of 1 to 3mm, a width of at least 5mm and open cells of 20 to 70kg/m<sup>3</sup>. The elastic bands 37 are joined, as shown in Fig. 18, onto the topsheet 11 and the backsheet 12 with, for example, with adhesive 38, 39 of hot melt type. Adhesive 38, 39 linear extends transversely of the

elastic bands 37 and applied onto the bands at regular intervals longitudinally of the bands or transversely of the diaper. Application interval of adhesive 38 used to join the topsheet 11 and the elastic bands 37 is larger than that for adhesive 39 used to join the backsheet 12 and the elastic bands 37. Thereby, the contractibility on an area on which the topsheet 11 is joined to the elastic bands 37 is stronger than the contractibility on an area on which the backsheet 12 is joined to the elastic bands 37. In consequence, the waist flaps 36 appropriately follow curves of the wearer's body to achieve a good fitness. Said manner in which adhesive is applied so as to establish a difference of said contractibility may be so modified that said adhesive is applied in a stripe extending longitudinally of the elastic bands 37 as a stripe extending longitudinally of said bands 37 while applied over a relatively wide area between the backsheet 12 and the elastic bands 37. In other words, the particular manner of application is not critical so long as said difference in the contractibility can be established. Furthermore, the elastic bands 37 preferably have their outer edges exposed between the respective outer edges of the topsheet 11 and the backsheet 12 so that a ventilation of the diaper between the inside and the outside thereof is facilitated through the elastic bands 37 made of

plastic foam having open cells. To this end, it is required for this plastic foam to have said thickness and said cell density. Moreover, a distance between the longitudinal outer edge of the absorbent body 13 and the inner edge of the associated elastic band 37 is preferably at least 5mm. With such distance, the fitness of the waist flaps 36 to the wearer's body, particularly the belly is further improved.

26871

WHAT IS CLAIMED IS:

1. A disposable diaper including a liquid-permeable topsheet, a liquid-impermeable backsheet, an absorbent body interposed between said both sheets and having a semi-rigidity, liquid-impermeable side flaps disposed on laterally opposite sides of said absorbent body and having a high flexibility, elastic bands adapted to form elastic gathers extending longitudinally of said side flaps and tape fasteners disposed on laterally opposite sides in a rear side area of the diaper; wherein each of said side flaps includes a first flap disposed outside said absorbent body and a second flap diverged from said first side flap, having the associated one of said elastic bands incorporated therein and turned up under an elastic effect of said associated elastic band at least along a line of the divergence.

2. A disposable diaper as defined by Claim (1), wherein said second flap has its longitudinal one side joined onto the upper side of said first flap, the other side directed outwards, of which longitudinally opposite ends fixed onto a front side area and a rear side area of the diaper and an intermediate portion rising upwards from a border line of the area over which said one side of the second flap is joined onto said first flap.

3. A disposable diaper as defined by Claim (2),  
wherein said second flap has its longitudinal one side  
joined onto the upper side of said first flap and the  
other side folded back outwards of which longitudinally  
5 opposite ends fixed onto the front side area and the  
rear side are of the diaper.

4. A disposable diaper as defined by Claim (1),  
wherein said second flap is made of a separate  
air-permeable and liquid-proof sheet different in  
10 nature from said first flap.

5. A disposable diaper as defined by Claim (1),  
wherein said first flap and said second flap are formed  
by the respective portions of said topsheet and said  
backsheet extending outwardly from each outer edge of  
15 said absorbent body.

TAKAMITSU IGAUE  
HIDEAKI KITAOKA  
HIROYUKI TANJI

Inventors

FIG. 1

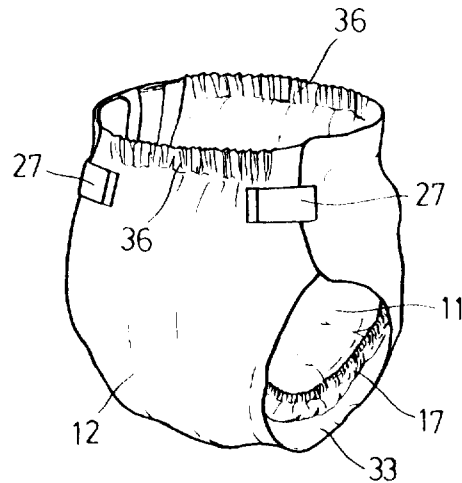
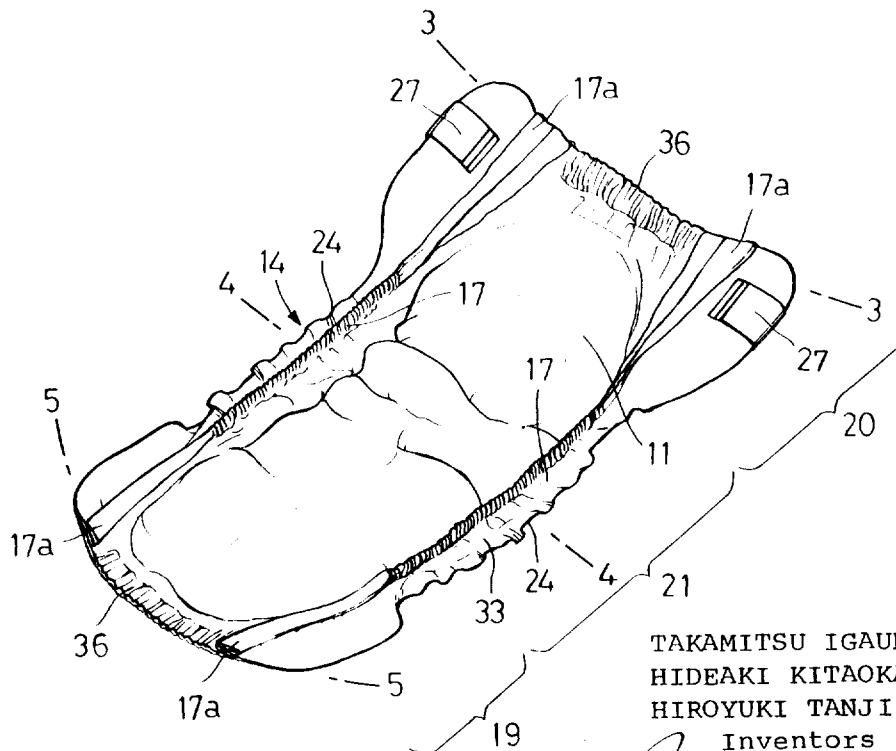


FIG. 2



TAKAMITSU IGAUE  
HIDEAKI KITAOKA  
HIROYUKI TANJI  
Inventors

TAN, SAAALO, MANZANO & VELEZ

BY:

Attorneys

FIG.3

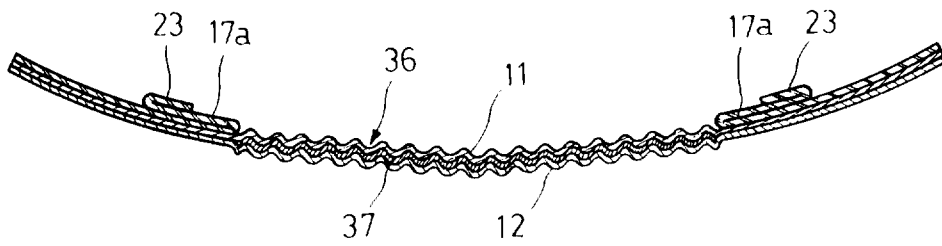


FIG.4

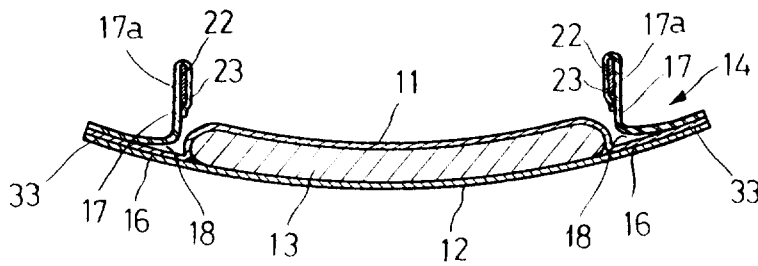
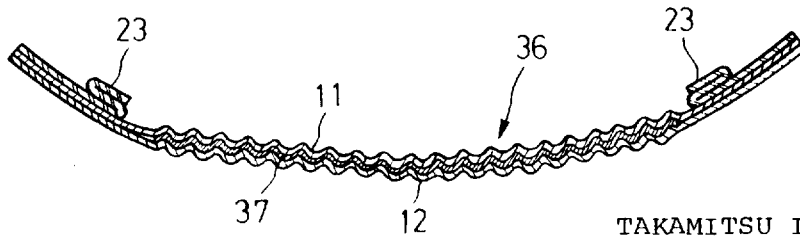


FIG.5



TAKAMITSU IGAUE  
HIDEAKI KITAOKA  
HIROYUKI TANJI  
Inventors

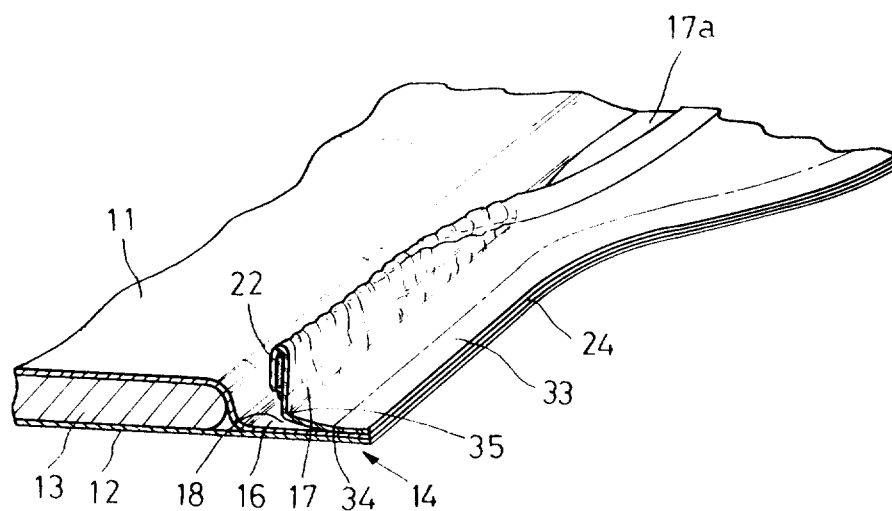
TAN, SAPALO, MANZANO & VELEZ

BY:

*Francisco E. Velez*  
Attorneys



FIG.6



TAKAMITSU IGAUE  
HIDEAKI KITAOKA  
HIROYUKI TANJI

Inventors

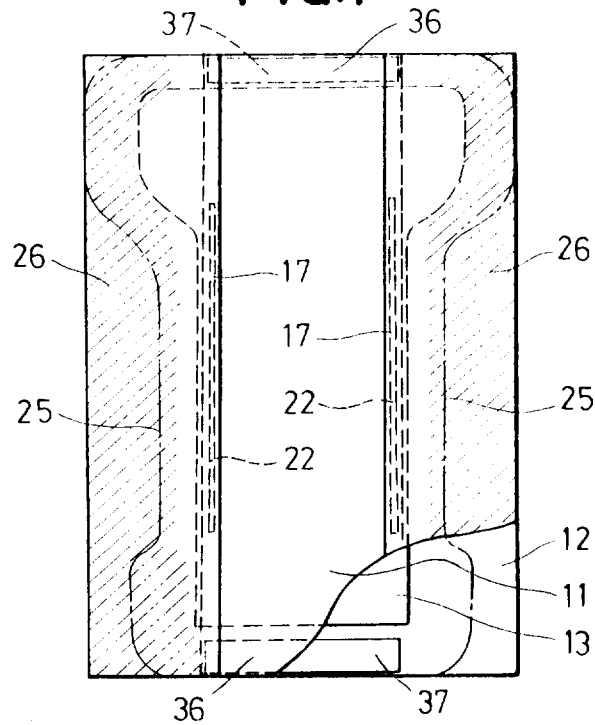
TAN, SAPPALO, MANZANO & VELEZ

BY:

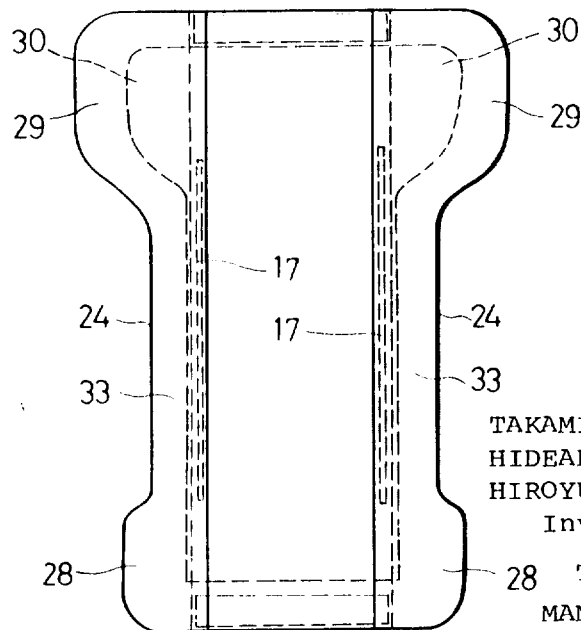
*Aracata A. Velez*

Attorneys

**FIG.7**



**FIG.8**



TAKAMITSU IGAUE  
HIDEAKI KITAOKA  
HIROYUKI TANJI  
Inventors

TAN, SAPALO,  
MANZANO & VELEZ

BY:

Attorneys

**FIG. 9**

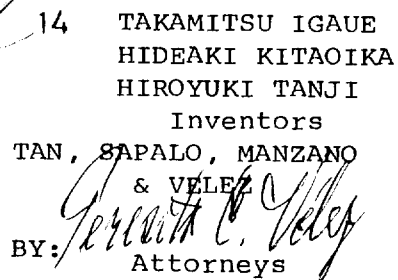
FIG. 9 is a perspective view of a book binding. It shows a central spine (17) with a top edge (18) and a bottom edge (18). The spine is flanked by two side panels (17a). The top and bottom edges of the side panels are labeled 37 and 36. The spine is secured by two horizontal bands (27) at the top and bottom. The spine is also secured by two vertical bands (22) on each side. The spine is further secured by two horizontal bands (33) on each side. The spine is also secured by two vertical bands (33) on each side.

**FIG. 10**

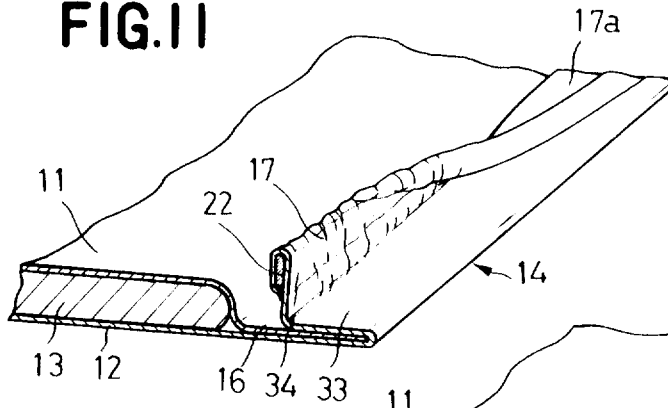
FIG. 10 is a perspective view of a book binding. It shows a central spine (17) with a top edge (18) and a bottom edge (18). The spine is flanked by two side panels (17a). The top and bottom edges of the side panels are labeled 37 and 36. The spine is secured by two horizontal bands (27) at the top and bottom. The spine is also secured by two vertical bands (22) on each side. The spine is further secured by two horizontal bands (33) on each side. The spine is also secured by two vertical bands (33) on each side.

11, 12, 13, 14, 16, 17, 22, 33, 34, 36, 37

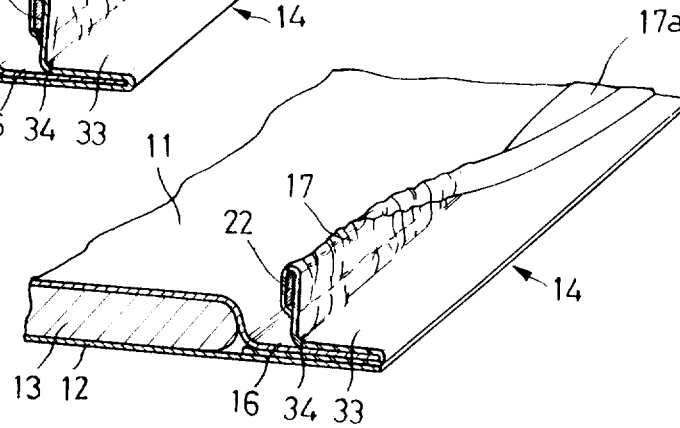
TAKAMITSU IGAUE  
HIDEAKI KITAOIKA  
HIROYUKI TANJI  
Inventors  
TAN, SAPALO, MANZANO  
& VELEZ  
BY: *Gerardo C. Velez*  
Attorneys



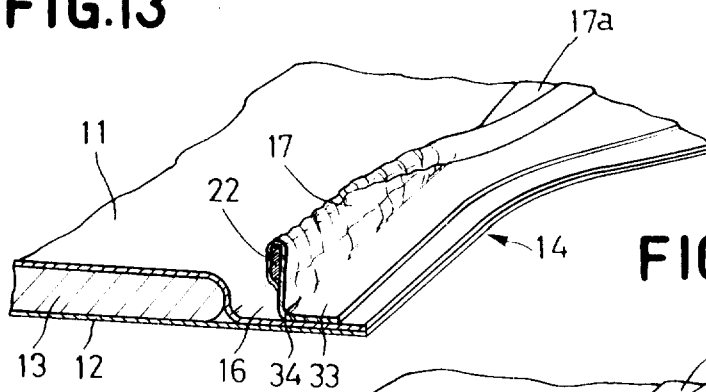
**FIG.11**



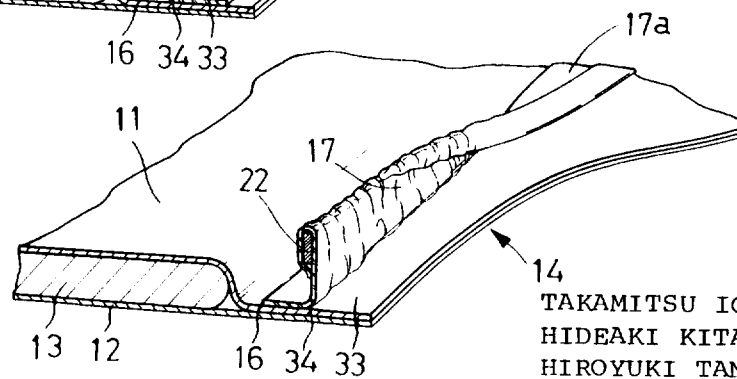
**FIG.12**



**FIG.13**



**FIG.14**



14  
TAKAMITSU IGAUE  
HIDEAKI KITAOKA  
HIROYUKI TANJ I  
Inventors  
TAN, SAPALO, MANZANO  
& VELEZ  
BY: *[Signature]*  
Attorneys

FIG.15

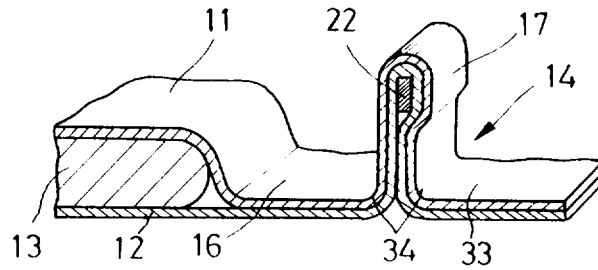


FIG.16

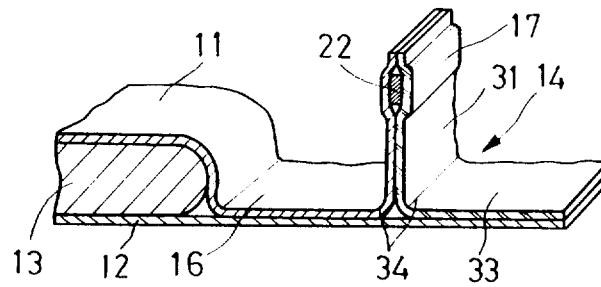


FIG.17

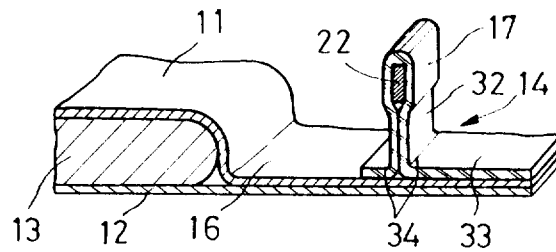
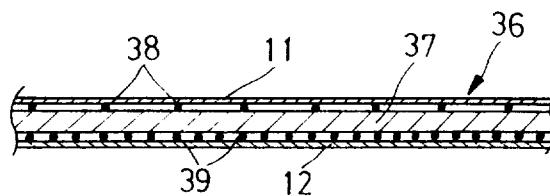


FIG.18



TAKAMITSU IGAUE  
HIDEAKI KITAOKA  
HIROYUKI TANJI

TAN, SAPALO, MANZANO &

VELEZ

BY:

Attorneys