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GB 1389891**

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A61F**

(54) **Absorbent article such as a diaper,
an incontinence protector or a sanitary
napkin**

(57) The characteristic feature of the invention is that the absorption body is constructed with at least two layers of which a first layer (1) is soft and placed closest to the user, whereas a second heavily compressed layer (2) is narrower than the first one and has a width adapted to the crotch of the user, the second layer being highly resistant to bending and being stable with regard to its form under normal stresses of use.

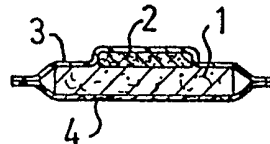


FIG. 3

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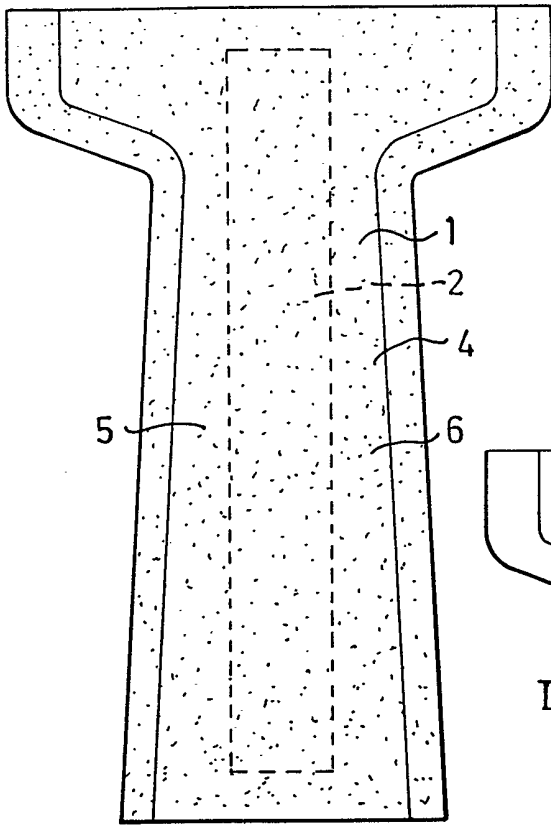


FIG. 1

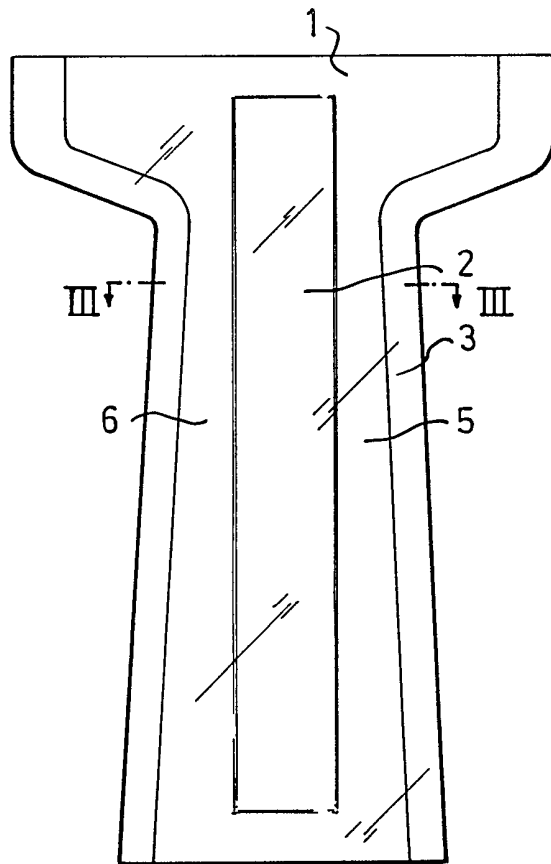


FIG. 2

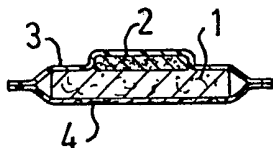


FIG. 3

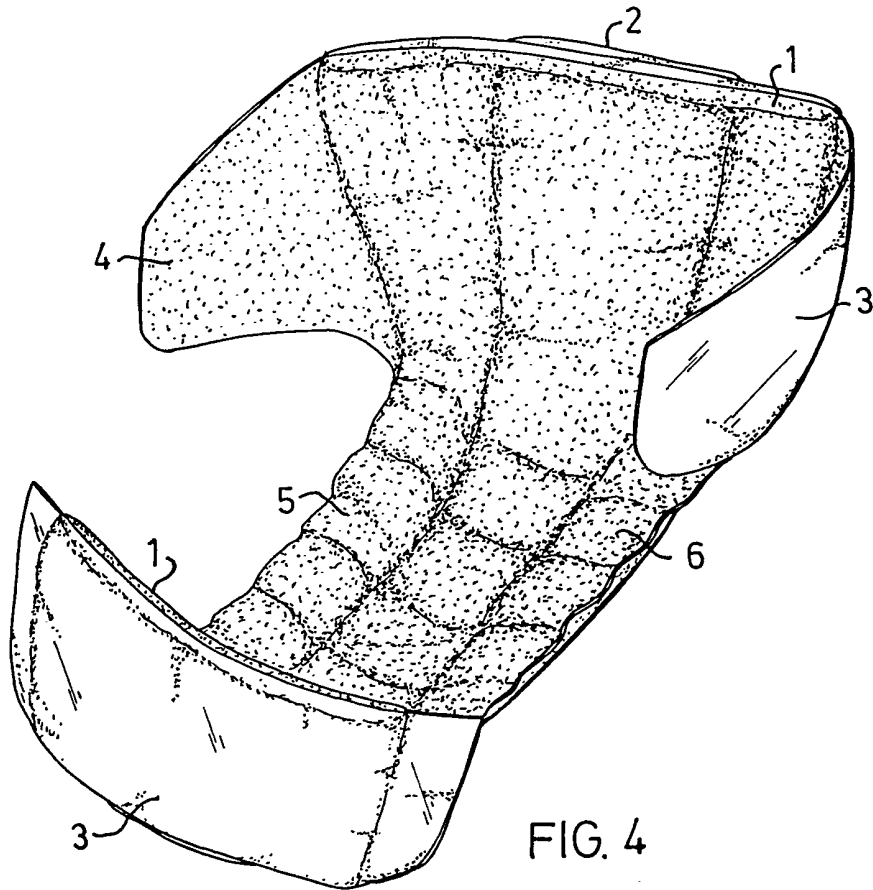


FIG. 4

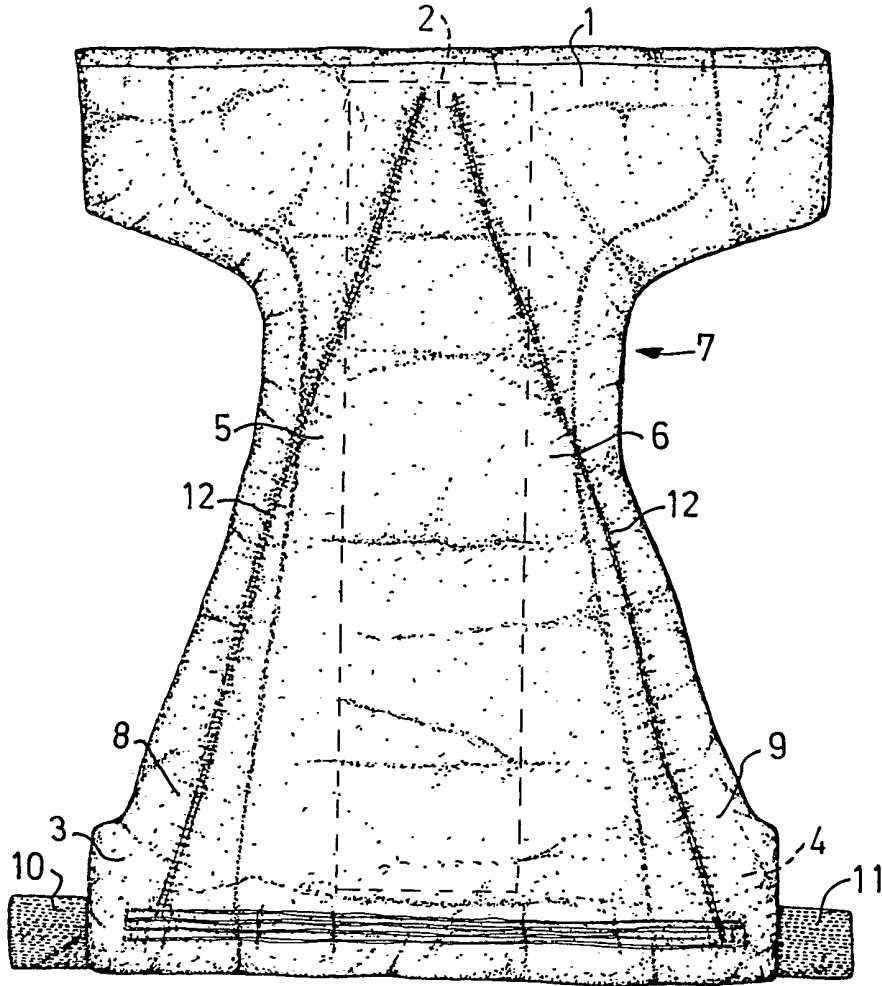


FIG. 5

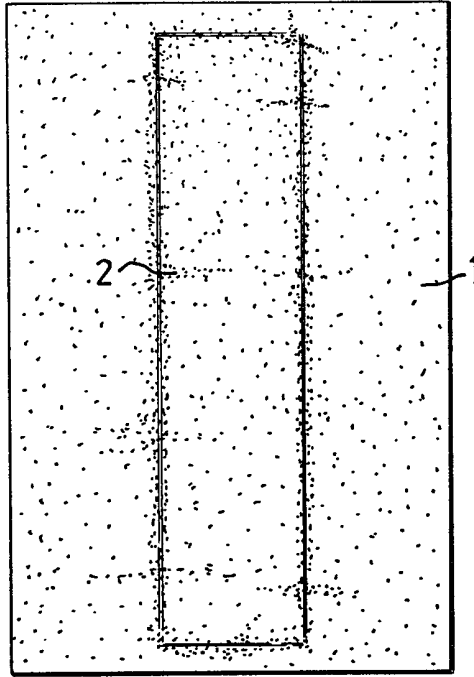


FIG. 6

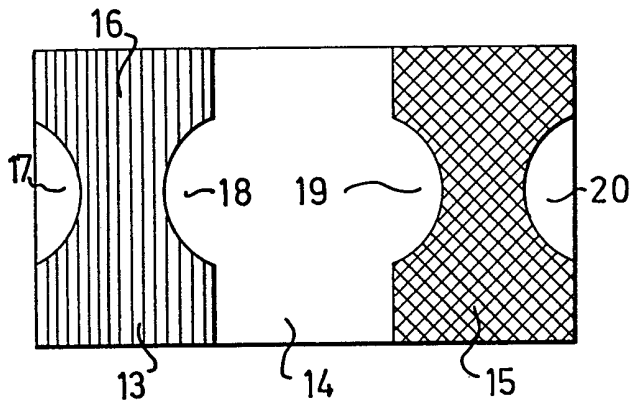


FIG. 7

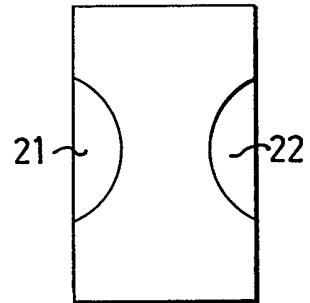


FIG. 8

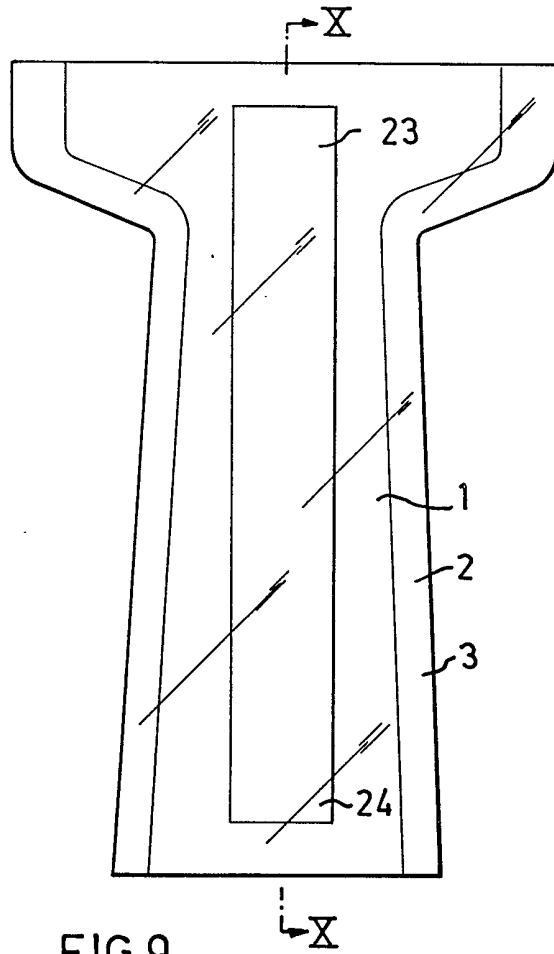


FIG. 9

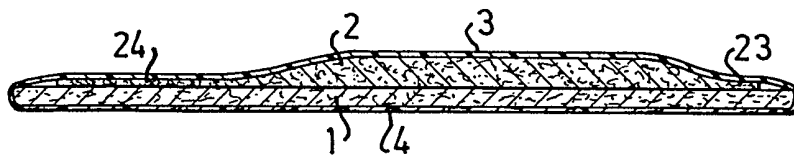


FIG. 10

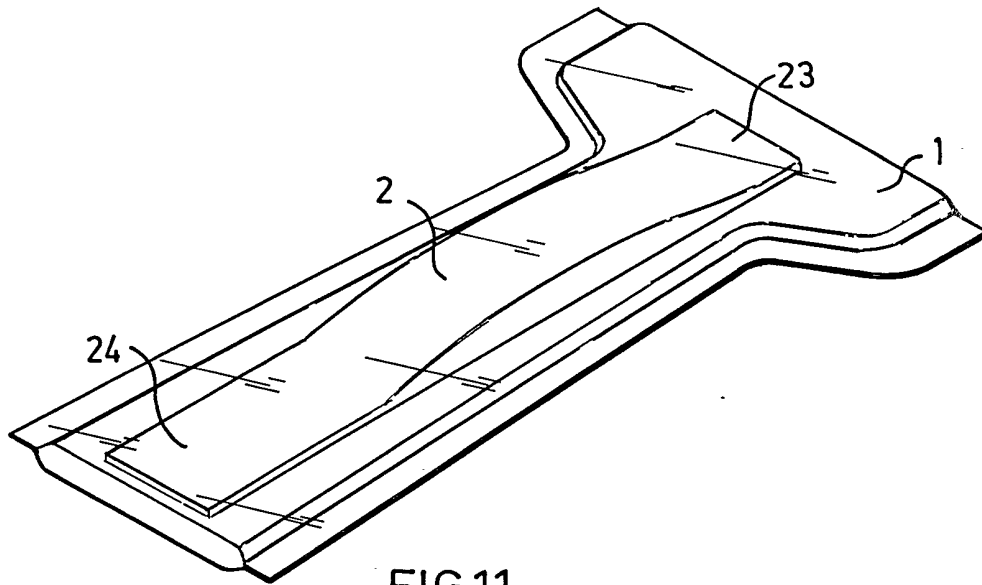


FIG.11

SPECIFICATION

Absorbent article such as a diaper, an incontinence protector or a sanitary napkin

5 The present invention relates to an absorbent article such as a diaper, an incontinence protector or a sanitary napkin including an absorption body surrounded by a casing.

10 Examples of prior art bodily adapted diapers are so-called wing-folded diapers which are folded to form a narrow center portion for the application to the crotch of the user while having wider end portions surrounding the abdomen. Folded diapers have certain drawbacks however, such as the difficulty of providing a satisfactorily close fit around the legs, and the tendency of creases, produced by the bodily movements of the user, to be misplaced allowing fluid to flow sideways out of the diaper along unintentionally formed wrinkles.

20 A conventional type of diaper is that designed as an hourglass. The problem with these diapers is the shortage of absorption material in the diaper crotch portion which will therefore disintegrate in the narrow center portion during use. The absorption material in the diaper is not appropriately utilized resulting in fluid being collected in the narrow mid-portion causing lateral leakage upon saturation of the crotch region, instead of the fluid being spread along the length of the diaper.

30 Attempts have been made to eliminate leakage of fluid by the attachment of elastic means for a tight fit around the legs of the user. A diaper provided with elastic ribbons is disclosed in US Patent 3 860 003. The absorption body has hourglass configuration, and the distinguishing feature of the diaper according to this US patent is the arrangement of flexible side flaps in the crotch area, elastic ribbons being affixed to said flaps at a distance of at least 19 mm from the side edges of the absorption body. According to said patent, this distance is crucial. By securing said minimum distance, the "semi-rigid" absorption core is said to be laterally displaceable in the crotch area at normal movements of the legs, without the elastic means in the side flap edges being pulled by the absorption body from their seal around the legs of the user. Although leakage has been reduced as compared to previously known hourglass-shaped diapers, there is still the substantial risk of urine being collected under the flexible flaps, giving rise to skin irritation in the sensitive crotch area, especially where the elastic means are in chafing contact with the bare skin.

55 The term "semi-rigid" in US Patent 3 860 003 is incorrect. An absorption body of the suggested type could rather be considered as a body having practically no, or possibly only an insignificant degree, of inherent rigidity. The thickness of the absorption core however makes it more rigid than the flexible flaps, which are formed of the thin plastics layer and a likewise thin nonwoven layer. The inherent rigidity of the absorption body is however still negligible, making the absorption body conform to the body of the user and allowing it to be folded beyond control in response to the movements of the user's legs.

Accordingly, undesired folds may occur in the crotch area of the absorption body, and urine may flow out sideways along said folds. In such cases the elastic means around the legs will provide no guarantee whatsoever against leakage. An essential problem associated with the diapers according to US Patent 3 860 003 is also the tendency of the narrow crotch portion of the absorption body to easily disintegrate and be completely broken there.

70 In U S Patent 4 326 528 there is suggested another alternative for attempting to adapt the diaper to the body of the user while trying to avoid leakage. The crotch portion in the diaper of US Patent 4 326 528 contains a substantially larger amount of absorption material than that of US 3 860 003. The diaper of US 4 326 528 is characterized by a planar or arched bottom, i.e. the lowermost portion when using the diaper, and by two planar sides connected to the bottom via folding areas such as stamped folding lines for example. Said planar sides include absorption material, and in contrast to the diapers according to US 3 860 003, the sides as well have a certain inherent rigidity. By designing the planar side with substantially the same insignificant bending resistance as that of the bottom, there is obtained a pocket in which urine can be collected. Although there is obtained a comparatively tight diaper in this manner, the disadvantage is the formation of a clumsy "bag" descending from the crotch of the user.

95 Furthermore, the absorption material described possesses no true rigidity but may be folded beyond control when the user sits down, with the risk of urine leaking out via unintentional and uncontrollable folds in the crotch area when the user is sitting. With the present invention there is achieved a diaper which with regard to function is superior to prior art diapers of the types described above, for example.

100 The disposable diaper according to the invention is distinguished in that the absorption body includes a first layer which is to be applied in contact with the user and which is soft, without or with only a slight degree of bending resistance and with a bulk of more than 13 cm³/g, and a second layer which is narrower than the first layer and which has a width adapted to the crotch of the user while being heavily compressed with a bulk of less than 9 cm³/g, preferably between 4 and 8 cm³/g, obtaining thereby a high degree of bending resistance providing shape stability to this second layer at normal usage, said layer having an excellent liquid distribution capacity.

115 The heavily compressed second layer will impart to the diaper crotch portion such a stability that no undesired folds will occur. The narrow, heavily compressed second layer has a width which is adapted for accommodation in the crotch area of the user, and this rigid layer will therefore maintain the absorption body in a smooth, close contact to the crotch of the user.

125 The edge portions of the rigid second layer serve as a folding ruler for the soft first layer of the absorption body. When the diaper is tightened around the abdomen of the user, the edge portions of the first layer, which as a flexibility normal for conventional cellulose absorption bodies such as

those of US Patents 3 860 003 and 4 326 528 for example and which extend along and outside the second layer, will be forced to fold at the edges of the second layer in the crotch portion. In so-called complete disposable diapers where the casing is used for tightening the diaper around the body, the flexible first layer will be pulled by the casing when putting on the diaper so that said layer is folded at the aforementioned rigid edges. The edge portions of the first layer extending outside the rigid second layer will therefore be forced into sealing contact around the legs of the user.

An additional substantial advantage with the narrow, heavily compressed absorption layer is the fact that absorbed liquid is sucked into this layer from the soft absorption layer, whereby the edge portions of the soft absorption layer, extending laterally outside the heavily compressed layer, will remain dry. the risk of leakage at the side edges is thereby reduced as compared to prior art diapers.

One preferred embodiment of the present invention is an absorbent article where additional layers, narrower than the second heavily compressed absorption layer are applied outside that layer so that the absorption body is given a cross section which tapers outwards in the direction away from the user, those possible additional layers having a bulk which is equal to, or less than that of the underlying second layer.

According to a preferred embodiment, elastic means are attached longitudinally or transversely to the diaper at least in the midportion, said means being utilized for folding the edge portions of the flexible first layer around folding lines formed by the edges of the rigid layer, the absorption core and thereby the entire diaper forming in the crotch portion a substantially U-shaped channel, seen in cross section. In the crotch portion, the elastic means act solely inside the edges of the first absorption layer and will therefore not give rise to chafing.

A further preferred embodiment possesses elastic means extending across the article from one side edge to the other where those means are applied either as a plurality of substantially parallel means or consist of at least two elastic means intersecting each other.

A substantial advantage associated with the inventive diaper is that the second layer is so heavily compressed, to a bulk below $9 \text{ cm}^3/\text{g}$ that urine is not only rapidly sucked into the second layer from the first layer facing the user, but is also vertically spread from the wetting point along the second layer, which is something quite impossible with previously known diapers. When the user stands up or sits down, a large portion of the absorbent material in a diaper is situated vertically above the wetting point. In prior art diapers the absorbent material has not been compressed enough for the capillary channels to suck vertically, but the liquid has remained around the wetting point and accordingly, the absorbent material has not been utilized to a sufficient degree.

The invention will be described in more detail below while referring to the embodiments illustrated in the drawings, or which

Figure 1 is a plan view of a diaper according to the

invention as seen in the direction to the side facing the user of the diaper;

Figure 2 is a plan view of the opposing side of the diaper; and

Figure 3 shows a section along lines III-III in *Figure 2*;

Figure 4 shows the diaper of *Figures 1-3* in its state of use;

Figure 5 is a plan view of a diaper according to a second embodiment as seen in the direction towards the side of the diaper facing the user;

Figure 6 is a plan view of a third embodiment;

Figure 7 is a plan view of the construction of a diaper according to a further embodiment;

Figure 8 shows a diaper folded from the blank according to *Figure 7*;

Figure 9 is a plan view of a diaper according to a still further embodiment;

Figure 10 shows a longitudinal section along line X-X of the diaper according to *Figure 9*; and

Figure 11 is a perspective view of the absorption body in the diaper according to *Figures 9-10*.

The diaper according to *Figures 1-3* consists of an absorption body and a casing surrounding it. The absorption body is made of two layers of fluff pulp, of which the first layer 1 has a bulk exceeding $13 \text{ cm}^3/\text{g}$, which is normal standard for absorption bodies in diapers, whereas the second layer 2 is heavily compressed with a bulk of less than $9 \text{ cm}^3/\text{g}$, preferably between 4 and $8 \text{ cm}^3/\text{g}$.

The casing consists of a liquid impermeable outer layer 3 on the diaper back, and a liquid permeable outer layer 4 on the diaper front, these two outer layers being united around the absorption body.

As seen in *Figures 2* and *3*, the heavily compressed layer 2 is comparatively narrow in comparison with the soft layer 1 which is intended to be applied closest to the user's body. The width of the rigid layer 2 is adapted to the crotch of the user, since the layer in question has such large bending resistance at the bulk mentioned that the form of said layer will substantially remain stable under normal stresses of use; i.e. when the diaper is put on, there will occur no undesired twisting of the absorption body which would give rise to leakage. The edges of the rigid layer 2 serve as a folding ruler for the soft layer, and when putting on the diaper, the portions 5, 6 extending outside the edges of the rigid layer will fold under control while forming, in accordance with *Figure 4*, a U-shaped channel in the crotch region of the diaper.

Due to the extremely heavy compression of the second layer 2, there is obtained a superior liquid transferring and retaining capacity as compared with prior art absorption bodies. The powerful compression will enable liquid to be transferred vertically from the lowermost point of the diaper, which is something quite impossible with conventional absorption bodies. Although it is previously known to provide diapers with compressed liquid distribution lines, these flow channels have not been sufficiently compressed and, above all, their capacity has not contributed to any significant degree of vertical liquid distribution.

The liquid transferring and retaining capacity of

the heavily compressed rigid layer 2 in the inventive diaper remains dry. In diapers known up to now, the fluid has been collected in the bottom region of the diaper, rapidly wetting the entire portion of the absorption body situated lowermost during use of the diaper, whereas the absorbent material in the main diaper portion has not at all contributed to the absorption of fluid. The diaper of Figures 1-4 is intended to be held in place with the aid of an elastic baby pant.

Figure 5 illustrates a so-called complete disposable diaper. The casing enclosing the absorption body consists of a liquid impermeable layer 3 and a liquid permeable layer 4, said two layers extending laterally outside the absorption body while being interconnected there.

The two outer layers 3,4 extend from the crotch portion 7 and rearwards with a gradually increasing distance outwards from the side edges of the absorption body, substantially triangular side flaps 8,9 being formed in this way onto which are affixed strips of tape 10,11. When putting on the diaper, the casing serves as a kind of pant, and the strips of tape 10,11 affixed to the rear side flaps 8,9 are attached to the outside of the diaper front end.

The soft layer of the absorption body has been given the reference numeral 1, and the heavily compressed layer is denoted 2. This compressed layer, indicated by dashed lines in Figure 5 has substantially the same configuration as the heavily compressed layer in the diaper of Figures 1-4.

The diaper of Figure 5 is provided with elastic means 12 extending in a V-shaped pattern across the center of the diaper front end. The elastic means intersects the edges of the soft layer 1 just behind the crotch portion, the soft layer preventing in this manner the elastic means from chafing the crotch of the user. With the aid of said prestretched elastic means, the soft layer 1 and the casing are folded along the edges of the rigid layer 2 in the diaper crotch portion for creating a substantially U-shaped channel. The elastic means further serves as a seal on the outside of the user's thighs.

Figure 6 illustrates a rectangular diaper having, in addition to a conventional soft absorption layer 1 of fluff pulp, a heavily compressed layer 2 of the same design as that of Figures 1-5. The absorption bodies are enclosed in a casing of non-woven fabric.

Rectangular diapers are normally used in combination with plastic backings being tied around the user. With prior art rectangular diapers there is the risk of the absorption body in the crotch area being crumpled up in an undesirable manner, which could give rise to leakage. The heavily compressed layer 2 acts to stabilize the crotch portion of the diaper thereby eliminating unintentional formations of wrinkles.

Figure 7 illustrates the blank for a modified rectangular diaper. The diaper blank consisting of fluff pulp has three different zones 13, 14 and 15. The diaper blank is produced by fluff pulp being fed past a number of compression wheels displaced in the transverse direction of the web (not shown). The centrally located zone 14 has a compression which is normal standard for diaper absorption bodies; they

are soft and fluffy with a bulk exceeding $13 \text{ cm}^3/\text{g}$.

The edge zone 13, which is to be folded in over the central zone, is compressed along separate longitudinal distribution lines 16, except at the areas 17 and 18, shaped as segments of a circle, where the fluff pulp is only loosely compressed, as in the central zone 14.

The edge zone 15, which is to be folded over the bent-in edge zone 13 for creating the absorption body of a diaper, is heavily compressed to a bulk of less than $9 \text{ cm}^3/\text{g}$, except in the areas 19 and 20, shaped as segments of a circle, where the fluff pulp is loosely compressed.

The finally folded absorption body is enclosed in a casing of non-woven material (fibrous fabric) for producing a diaper.

This diaper is shown in Figure 8. The advantage of such a design is that the layer 15 can be compressed both in the crotch area and at the end portions, imparting thereby appropriate stability, good liquid distribution and small volume to the diaper.

The diaper has soft, loosely compressed leg recesses 21, 22 enabling it to be safely retained, since no longitudinal displacement can occur due to the heavily compressed layer 15.

The circular side boundaries of the heavily compressed layer 15 constitute a folding ruler for the other layers of the diaper in this area.

Figures 9-11 illustrate a diaper which, like the diaper according to Figures 1-4, is intended for wear together with an elastic baby pant. As in Figures 1-4, this diaper as well consists of an upper, loosely compressed absorption layer 1, a lower, heavily compressed absorption layer 2 and a casing encapsulating the absorption body and having a liquid impermeable portion 3 on the diaper backsheet and a liquid permeable portion 4 on the diaper topsheet.

The heavily compressed layer 2 has a bulk which is less than $9 \text{ cm}^3/\text{g}$ in all portions of the layer, said bulk diminishing in response to the increasing degree of compression towards the end portions 23,24 of the layer in question.

By further compressing the end portions of the already rather heavily compressed layer, there is achieved a strengthened liquid-distributing effect resulting in increased dryness in the diaper crotch portion due to the action of the capillary forces, which provides for the transfer of fluid from coarser capillaries to finer capillaries, i.e. from a lower to a higher degree of compression.

The two layers included in the absorption body can be interconnected, for example by the treatment of the sides facing each other with water or hot melt spray prior to joining them. The layers may also be united by compression riveting, i.e. by subjecting the two layers to heavy compression at a plurality of spaced points, the layers thereby being effectively prevented from sliding in relation to one another.

The upper, soft layer 1 can be a porous layer purely serving a liquid-distributing purpose, totally lacking absorbency. The primary function of this layer is thus to act as a distance layer keeping the wet, absorbing layer 2 from direct contact with the wearer's skin. Because of air being allowed to circulate through the layer, there is simultaneously

achieved a better ventilation of the sensitive skin in the crotch region.

A suitable non-absorbent material useful for this purpose is synthetic fiber wadding, preferably with long fibers, obtaining in this manner a mechanically rebounding layer with good liquid insulation capacity against rewetting the user with moisture coming from the bottom layer.

In the T-shaped diapers illustrated in Figures 1-4 and 9-11 and intended for use in combination with a baby pant, the forward portion facing the abdomen of the wearer during use, can be made thicker than the rest of the diaper, preventing in this way the diaper from slipping backwards in the baby pant when the user is moving.

If one or both end portions of the heavily compressed layer 2 is subjected to additional compression, there will be no need for the increase in density to be continuous from the center and towards the end or ends, but it can instead be arranged as a uniform, higher compression of one or both of the end portions.

The invention is not restricted to the embodiments here described, but a plurality of modifications are possible within the scope of the following claims. For example, the diaper may be provided with transverse elastic means in the crotch portion, forcing in this manner the soft absorption layer to fold at the edges of the more rigid layer.

The invention has been described in connection with disposable diapers, the problems however being identical for incontinence protectors and sanitary napkins. Such products could to advantage be provided with a rigid layer preventing said products from twisting in an undesirable manner while simultaneously minimizing the risk of side leakage.

CLAIMS

1. An absorbent article such as a diaper, an incontinence protector or a sanitary napkin including an absorption body made of cellulose pulp and a casing enclosing it, wherein the absorption body includes a first layer for application closest to the user, which layer is soft and has no or only a slight degree of bending resistance and with a bulk of more than $13 \text{ cm}^3/\text{g}$ and a second layer which is narrower than the first layer and has a width adapted to the crotch of the user while being heavily compressed and having a bulk of less than $9 \text{ cm}^3/\text{g}$, which provides a high degree of bending resistance and imparts shape stability to the second layer during normal usage, the second layer having a very high liquid distributing capacity.

2. An absorbent article as claimed in claim 1 wherein the heavily compressed second layer has a bulk of from $4 \text{ cm}^3/\text{g}$ to $8 \text{ cm}^3/\text{g}$.

3. An absorbent article as claimed in claim 1 or claim 2 wherein additional layers, narrower than the second layer, are applied outside that layer, so that the absorption body is given a cross section which tapers outwardly in the direction away from the user, the additional layers, having a bulk which is equal to or less than that of the underlying second layer.

4. An absorbent article as claimed in any one of the preceding claims wherein elastic means are applied in the longitudinal or transverse direction of the article at least at the midportion thereof, the elastic means serving to fold the edge portions of the flexible first layer around folding lines formed by the edges of the rigid layer, the absorption core, and thereby the entire diaper crotch portion thus creating a channel which is substantially U-shaped in cross section.

5. An absorbent article as claimed in claim 4, wherein the elastic means extend across the article from one side edge to the other and are applied either as a plurality of substantially parallel means, or consist of at least two elastic means intersecting each other.

6. An absorbent article as claimed in claim 4, which is a diaper wherein the first layer has a configuration adapted to the bodily shape of the user, and at least one of the absorption body end portions is wider than the absorbent body midportions, the crotch portion; and the elastic means are applied along the length of the diaper while extending a substantially V-shaped pattern with the apex of the pattern being disposed at the diaper front end, and the elastic means intersecting the first layer beside the side edges of the rigid second layer in the diaper crotch portion for the purpose of forcibly folding up the side edges of the first layer behind the intersecting points along fold lines created by the edges of the rigid layer.

7. An absorbent article as claimed in any one of the preceding claims, wherein the second layer included in the absorption body has a bulk in its centre portion which is less than $9 \text{ cm}^3/\text{g}$, whereas at least one end portion of the second layer has a still higher degree of compression.

8. An absorbent article as claimed in claim 1 or claim 2 wherein the second layer, starting from the crotch portion, has a density continually increasing in the direction towards one or both of the end portions.

9. An absorbent article as claimed in any one of the preceding claims, wherein the first and the second layers are bonded together.

10. An absorbent article as claimed in claim 9 wherein the bonding is by means of the hot melt.

11. An absorbent article substantially as hereinbefore described with reference to and as shown in the accompanying drawings.