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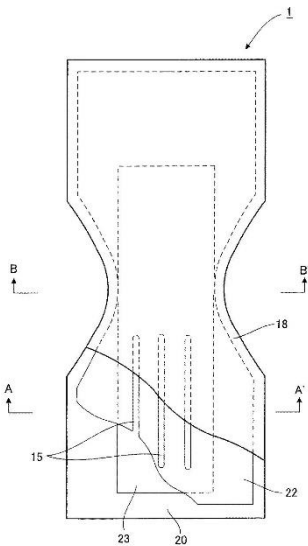
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(54) [Title of the Invention]  
Absorbent Article

(57) [Abstract]  
[Problem] To provide an absorbent article with excellent excretory fluid absorbency and a good fit on the wearer.

[Solution] The absorbent article 1 of the present invention comprises an absorbent material 22, a top sheet 18 made at least partially of a liquid-permeable material and disposed so as to cover the top surface of the absorbent material 22, and a back sheet 20 made of a liquid-impermeable material and disposed on the back surface of the absorbent material 22. In the absorbent article 1, the absorbent material 22 has hole portions 15 that penetrate from the top surface to the back surface of the absorbent material 22, the top sheet 18 is disposed on the top surface of the absorbent material 22, and a diffusion sheet 23 with higher liquid permeability than the absorbent material 22 is disposed on the back surface of the absorbent material 22 so as to cover the region including the openings in the hole portions 15.

[Selected Drawing] Fig. 1



## [Claims]

## [Claim 1]

An absorbent article comprising an absorbent material, a top sheet made at least partially of a liquid-permeable material and disposed so as to cover the top surface of the absorbent material, and a back sheet made of a liquid-impermeable material and disposed on the back surface of the absorbent material, wherein a hole portion that penetrates from the top surface to the back surface of the absorbent material is formed in the absorbent material, the top sheet is disposed on the top surface of the absorbent material, and a diffusion sheet with higher liquid permeability than the absorbent material is disposed on the back surface of the absorbent material so as to cover the region including an opening in the hole portion.

## [Claim 2]

The absorbent article according to claim 1, wherein the top sheet covers the top surface of the absorbent material as well as covering the inner surface of the hole portion in the absorbent material, and the diffusion sheet exposed by the hole portion, and the top sheet and the diffusion sheet are joined at the opening in the hole portion on the back surface side of the absorbent material.

## [Claim 3]

An absorbent article comprising an absorbent material, a top sheet made at least partially of a liquid-permeable material and disposed so as to cover the top surface of the absorbent material, and a back sheet made of a liquid-impermeable material and disposed on the back surface of the absorbent material, wherein the absorbent material has a first absorbent material and a second absorbent material, a hole portion that penetrates from the top surface to the back surface of the first absorbent material is formed in the first absorbent material, the top sheet is disposed on the top surface of the first absorbent material, and a diffusion sheet with higher liquid permeability than the first absorbent material is disposed between the first absorbent material and the second absorbent material so as to cover the region including an opening in the hole portion in the first absorbent material.

## [Claim 4]

The absorbent article according to claim 3, wherein the top sheet covers the top surface of the first absorbent material as well as covering the inner surface of the hole portion in the first absorbent material, and the diffusion sheet exposed by the hole portion, and the top sheet and the diffusion sheet are joined at the opening in the hole portion on the back surface side of the first absorbent material.

## [Claim 5]

The absorbent article according to claim 3 or 4, wherein a hole portion that penetrates from the top surface to the back surface of the second absorbent material is formed in the second absorbent material, the back sheet covers the back surface of the second absorbent material as well as covering the inner surface of the hole portion in the second absorbent material, and the back surface of the diffusion sheet exposed by the hole portion in the second absorbent material, and the back sheet and the diffusion sheet are joined at the opening in the hole portion on the back surface side of the second absorbent material.

[Claim 6]

An absorbent article comprising an absorbent material, a top sheet made at least partially of a liquid-permeable material and disposed so as to cover the top surface of the absorbent material, and a back sheet made of a liquid-impermeable material and disposed on the back surface of the absorbent material, wherein the absorbent material has a first absorbent material and a second absorbent material, a hole portion that penetrates from the top surface to the back surface of the first absorbent material is formed in the first absorbent material, a hole portion that penetrates from the top surface to the back surface of the second absorbent material is formed in the second absorbent material, the top sheet is disposed on the top surface of the first absorbent material, a first diffusion sheet with higher liquid permeability than the first absorbent material is disposed between the first absorbent material and the second absorbent material so as to cover the region including an opening in the hole portion of the first absorbent material, and a second diffusion sheet with higher liquid permeability than the second absorbent material is disposed on the back surface of the second absorbent material so as to cover the region including an opening in the hole portion in the second absorbent material.

[Claim 7]

The absorbent article according to claim 6, wherein the top sheet covers the top surface of the first absorbent material as well as covering the inner surface of the hole portion in the first absorbent material, and the first diffusion sheet exposed by the hole portion, and the top sheet and the first diffusion sheet are joined at the opening in the hole portion on the back surface side of the first absorbent material.

[Claim 8]

The absorbent article according to any of claims 5 to 7, wherein the hole portion in the first absorbent material and the hole portion in the second absorbent material are formed in different positions.

[Claim 9]

The absorbent article according to any of claims 5 to 7, wherein the hole portion in the first absorbent material and the hole portion in the second absorbent material are formed in the same position.

[Claim 10]

The absorbent article according to any of claims 1 to 9, wherein the hole portion formed in the absorbent material is elongated in shape with the opening in the hole portion extending in the longitudinal direction of the absorbent material.

[Claim 11]

The absorbent article according to any of claims 1 to 10, wherein the hole portion in the absorbent material is formed at an excretory site of the wearer.

[Detailed Description of the Invention]

[Technical Field]

[0001]

The present invention relates to an absorbent article. The present invention relates more specifically to an absorbent article having excellent absorbency of excretory fluid.

[Background Art]

[0002]

Absorbent articles are used in disposable diapers (for example, tape-style diapers, pants-style diapers, urine pads, etc.) that absorb excretory fluids such as urine, sanitary napkins that absorb menstrual blood, and vaginal discharge sheets that absorb vaginal discharge. For example, disposable diapers with a top sheet, a back sheet, and an absorbent material inserted partially between these two sheets are used as absorbent articles for infants, or for adults such as the elderly or the disabled.

[0003]

In such an absorbent article, for example, a disposable diaper, when the top surface of the top sheet is in contact with the wearer's skin, urine excreted by the wearer passes through the top sheet and is absorbed and retained by the absorbent material, while the back sheet, which has excellent leak-proof properties, prevents leakage of excretory fluid to the outside.

[0004]

In a conventional absorbent article, excretory fluid that has permeated through the top sheet is absorbed from the top surface side (the side facing the wearer's skin) of the absorbent material at the absorption rate of the absorbent material. However, when the rate of excretion exceeds the absorption rate of the absorbent material, or when a large amount of excretory fluid is excreted all at once, the excretory fluid flows over the top sheet. In such cases, the unabsorbed excretory fluid that flows over the top sheet covers a large area of the wearer's skin, causing not only an unpleasant sensation but also a rash. Excretory fluid that flows over the top sheet can also leak from the absorbent article.

[0005]

Excretory fluid absorbed from the top sheet side of the absorbent material, that is, from the top surface side of the absorbent material, tends to be unevenly distributed in the top surface side of the absorbent material in the thickness direction. Therefore, when the wearer exerts pressure, excretory fluid tends to flow back from the top sheet side, causing not only discomfort but also irritation and other problems.

[0006]

Because of these problems, an absorbent article with a diffusion layer disposed between the top sheet and absorbent material has been proposed. This disperses excretory fluid that cannot be fully absorbed by the absorbent material within the diffusion layer to temporarily retain the excretory fluid, and promote dispersion and absorption over a wider area, thereby effectively increasing the absorption rate, keeping excretory fluid from flowing over the top sheet, and preventing liquid leakage.

[0007]

Disposable diapers have been disclosed that have grooves formed in the longitudinal direction on the front and back surfaces of the absorbent material in order to provide excellent diffusion of excretory fluid in the longitudinal direction and improve fit by making the disposable diaper more bendable in the crotch portion (see, for example, Patent Documents 1 and 2).

[0008]

[Patent Document 1] JP 3616077 B2

[Patent Document 2] JP 2005-34652 A

[Disclosure of the Invention]

[Problem to Be Solved by the Invention]

[0009]

However, in conventional absorbent articles in which a diffusion layer is disposed between the top sheet and the absorbent material, the diffusion layer only expands the absorption area on the top sheet side of the absorbent material and is not sufficient to increase the absorption rate. Also, when a diffusion layer is disposed between the top sheet and the absorbent material, diffused excretory fluid is absorbed from the top surface of the absorbent material in a manner no different from an absorbent article without a diffusion layer, and does not solve the problem of excretory fluid being unevenly distributed on the top sheet side and tending to flow back from the top sheet side.

[0010]

The absorbent articles (disposable diapers) in Patent Documents 1 and 2 have excellent fit in that the grooves formed in the absorbent material allow the absorbent article to bend at the grooves and keep a gap from forming in the crotch portion. However, a configuration in which excretory fluid is absorbed from the top sheet to the top surface of the absorbent material is no different from that of ordinary absorbent articles, and the rate at which excretory fluid is absorbed is low. In Patent Documents 1 and 2, a method is disclosed in which a permeable sheet made of crepe paper is disposed between upper and lower absorbent materials to separate them. However, while excretory fluid diffuses through this permeable sheet in the planar direction, the rate at which excretory fluid moves along a permeable sheet made of crepe paper is extremely slow compared to the excretion rate of excretory fluid, and the absorption rate of the absorbent material is not increased by use of a permeable sheet made of crepe paper.

[0011]

It is an object of the present invention to solve these problems associated with the prior art by providing an absorbent article with excellent excretory fluid absorbency.

[Means for Solving the Problem]

[0012]

As a result of extensive research conducted to solve the problems associated with the prior art described above, the present inventor discovered that these problems could be solved by using, an absorbent material with a hole portion that penetrates from the top surface to the back surface of the absorbent material in an absorbent article with an absorbent material, a top sheet, and a back sheet, and by disposing a diffusion sheet with higher liquid permeability than the absorbent material on the back surface of the absorbent material, so as to cover the area including the opening in the hole portion. The present invention is a product of this discovery. More specifically, the present invention provides the following absorbent articles.

[0013]

[1] An absorbent article comprising an absorbent material, a top sheet made at least partially of a liquid-permeable material and disposed so as to cover the top surface of the absorbent material, and a back sheet made of a liquid-impermeable material and disposed on the back surface of the absorbent material, wherein a hole portion that penetrates from the top surface to the back surface of the absorbent material is formed in the absorbent material, the top sheet is disposed on the top surface of the absorbent material, and a diffusion sheet with higher liquid permeability than the absorbent material is disposed on the back surface of the absorbent material so as to cover the region including an opening in the hole portion (This is referred to as the "first absorbent article" below).

[0014]

[2] The absorbent article according to [1], wherein the top sheet covers the top surface of the absorbent material as well as covering the inner surface of the hole portion in the absorbent material, and the diffusion sheet exposed by the hole portion, and the top sheet and the diffusion sheet are joined at the opening in the hole portion on the back surface side of the absorbent material.

[0015]

[3] An absorbent article comprising an absorbent material, a top sheet made at least partially of a liquid-permeable material and disposed so as to cover the top surface of the absorbent material, and a back sheet made of a liquid-impermeable material and disposed on the back surface of the absorbent material, wherein the absorbent material has a first absorbent material and a second absorbent material, a hole portion that penetrates from the top surface to the back surface of the first absorbent material is formed in the first absorbent material, the top sheet is disposed on the top surface of the first absorbent material, and a diffusion sheet with higher liquid permeability than the first absorbent material is disposed between the first absorbent material and the second absorbent material so as to cover the region including an opening in the hole portion in the first absorbent material (This is referred to as the "second absorbent article" below).

[0016]

[4] The absorbent article according to [3], wherein the top sheet covers the top surface of the first absorbent material as well as covering the inner surface of the hole portion in the first absorbent material, and the diffusion sheet exposed by the hole portion, and the top sheet and the diffusion sheet are joined at the opening in the hole portion on the back surface side of the first absorbent material.

[0017]

[5] The absorbent article according to [3] or [4], wherein a hole portion that penetrates from the top surface to the back surface of the second absorbent material is formed in the second absorbent material, the back sheet covers the back surface of the second absorbent material as well as covering the inner surface of the hole portion in the second absorbent material, and the back surface of the diffusion sheet exposed by the hole portion in the second absorbent material, and the back sheet and the diffusion sheet are joined at the opening in the hole portion on the back surface side of the second absorbent material.

[0018]

[6] An absorbent article comprising an absorbent material, a top sheet made at least partially of a liquid-permeable material and disposed so as to cover the top surface of the absorbent material, and a back sheet made of a liquid-impermeable material and disposed on the back surface of the absorbent material, wherein the absorbent material has a first absorbent material and a second absorbent material, a hole portion that penetrates from the top surface to the back surface of the first absorbent material is formed in the first absorbent material, a hole portion that penetrates from the top surface to the back surface of the second absorbent material is formed in the second absorbent material, the top sheet is disposed on the top surface of the first absorbent material, a first diffusion sheet with higher liquid permeability than the first absorbent material is disposed between the first absorbent material and the second absorbent material so as to cover the region including an opening in the hole portion of the first absorbent material, and a second diffusion sheet with higher liquid permeability than the second absorbent material is disposed on the back surface of the second absorbent material so as to cover the region including an opening in the hole portion in the second absorbent material (This is referred to as the "third absorbent article" below).

[0019]

[7] The absorbent article according to [6], wherein the top sheet covers the top surface of the first absorbent material as well as covering the inner surface of the hole portion in the first absorbent material, and the first diffusion sheet exposed by the hole portion, and the top sheet and the first diffusion sheet are joined at the opening in the hole portion on the back surface side of the first absorbent material.

[0020]

[8] The absorbent article according to any of [5] to [7], wherein the hole portion in the first absorbent material and the hole portion in the second absorbent material are formed in different positions.

[0021]

[9] The absorbent article according to any of [5] to [7], wherein the hole portion in the first absorbent material and the hole portion in the second absorbent material are formed in the same position.

[0022]

[10] The absorbent article according to any of [1] to [9], wherein the hole portion formed in the absorbent material is elongated in shape with the opening in the hole portion extending in the longitudinal direction of the absorbent material.

[0023]

[11] The absorbent article according to any of [1] to [10], wherein the hole portion in the absorbent material is formed at an excretory site of the wearer.

[Effects of the Invention]

[0024]

The absorbent articles (first to third absorbent articles) of the present invention have excellent absorbency of excretory fluid. The absorbent articles of the present invention absorb excretory fluid at the excretory site on the top sheet side (top surface) of the absorbent material and allow some of the excretory fluid to pass through the hole portion in the absorbent material (the first absorbent material in the second and third absorbent articles). This penetrates into the diffusion sheet (the first diffusion sheet in the third absorbent article), which is more permeable to liquid than the absorbent material (the first absorbent material) and can be absorbed from the back surface of the absorbent material (first absorbent material) via the diffusion sheet (first diffusion sheet). Because excretory fluid can be absorbed over a wider area in this way, the absorbent articles of the present invention have a high excretory fluid absorption rate and excellent absorbency.

[0025]

The second and third absorbent articles have a second absorbent material on the back surface of the diffusion sheet disposed on the first absorbent material described above, which further improves absorbency of the absorbent articles.

[0026]

The third absorbent article has a second diffusion sheet on the back surface side of the second absorbent material so that excretory fluid can also be absorbed from the back surface of the second absorbent material via this second diffusion sheet. This further increases the rate at which excretory fluid is absorbed, making the article more absorbent.

[Best Mode for Carrying Out the Invention]

[0027]

The best mode for embodying the absorbent articles (first to third absorbent articles) of the present invention will now be described in great detail with reference to the drawings. Note, however, that the present invention broadly encompasses absorbent articles provided with the invention-specifying matters of the present invention and is not limited to the following embodiments.

[0028]

[1] Absorbent Articles:

The absorbent articles of the present invention (the first to third articles) comprise an absorbent material, a top sheet made at least partially of a liquid-permeable material and disposed so as to cover the top surface of the absorbent material, and a back sheet made of a liquid-impermeable material and disposed on the back surface of the absorbent material.

[0029]

These absorbent articles can be used in disposable diapers (for example, tape-style diapers, pants- style diapers, urine pads, etc.) that absorb excretory fluids such as urine, sanitary napkins that absorb menstrual blood, and vaginal discharge sheets that absorb vaginal discharge.

[0030]

[1-1] The First Absorbent Article:

The first absorbent article of the present invention, as seen in absorbent article 1 shown in Fig. 1 to Fig. 3, comprises an absorbent material 22, a top sheet 18 made at least partially of a liquid-permeable material and disposed so as to cover the top surface of the absorbent material 22, and a back sheet 20 made of a liquid-impermeable material and disposed on the back surface of the absorbent material 22. In this absorbent article 1, hole portions 15 that penetrate from the top surface to the back surface of the absorbent material 22 are formed in the absorbent material 22, the top sheet 18 is disposed on the top surface of the absorbent material 22, and a diffusion sheet 23 with higher liquid permeability than the absorbent material 22 is disposed on the back surface of the absorbent material 22 so as to cover the region including the openings in the hole portions 15. Here, Fig. 1 is a partially cutaway plan view of an embodiment of the first absorbent article of the present invention, showing the first absorbent article viewed from the top sheet side. Fig. 2 is a cross-sectional view of the first absorbent article in Fig. 1 from line A-A', and Fig. 3 is a cross-sectional view of the first absorbent article in Fig. 1 from line B-B'.

[0031]

In this configuration, the first absorbent article of the present invention absorbs excretory fluid excreted by the wearer from the top sheet side of the absorbent material (top surface of the absorbent material). Some of the excretory fluid can pass through the hole portions and quickly pass through and become diffused by the diffusion sheet, which has higher liquid permeability than the absorbent material. It can absorb excretory fluid from the back surface side of the absorbent material as well. Consequently, the first absorbent article can increase the area of the site that actually comes in contact with and absorbs the excretory fluid, which can greatly increase the absorption rate of the absorbent material. Therefore, the first absorbent article of the present invention can readily absorb a large amount of excretory fluid or excretory fluid traveling at a fast excretion rate that cannot be handled by conventional products, thereby preventing leakage.

[0032]

Also, because the first absorbent article of the present invention does not cause excretory fluid to become concentrated in one place, it is more likely to retain the absorbency of the absorbent material at the urination site (that is, in the crotch portion when worn) when excreted fluid is repeatedly excreted ("residual absorbency" below). Therefore, the absorbed excretory fluid is less likely to flow back (liquid backflow), for example, when the wearer applies body pressure to the absorbent article, if the absorption capacity is retained, resulting in less stickiness and better use of the absorbent article.

[0033]

Also, because excretory fluid can be directly absorbed from the back surface of the absorbent material as described above, the absorbed excretory fluid is not unevenly distributed on the top surface side of the absorbent material (that is, on the side with the wearer's skin), effectively preventing backflow of excretory fluid as described above.

[0034]

In the first absorbent article, the hole portions formed in the absorbent material are formed so that the opening in the hole portions has an elongated shape extending in the longitudinal direction of the absorbent material. In this way, the hole portions allow the absorbent material to bend and conform more closely to the wearer's urination site, improving wearer fit. When used as a disposable diaper consisting of a front piece, a crotch portion, and a rear piece, the fit around the legs can be improved to effectively prevent leakage from the leg area.

[0035]

In the absorbent article, a sheet with higher liquid permeability than the absorbent material disposed on the top surface side of the diffusion sheet is used as the diffusion sheet. The following method can be used to compare the liquid permeability of diffusion sheets with that of absorbent materials.

[0036]

First, two types of absorbent materials are prepared, namely, an absorbent material used in the absorbent article ("absorbent material A" below) and an absorbent material similar to absorbent material A with a diffusion sheet disposed on the top ("absorbent material B" below). Each absorbent material (absorbent materials A, B) is inserted between a top sheet and a back sheet, and the same amount of saline solution is absorbed as excretory fluid, and the time required for all of the saline solutions to be absorbed by the absorbent material (absorption time) is measured.

[0037]

If absorbent material B has a shorter absorption time, it means that the liquid permeability of the diffusion sheet is higher than that of the absorbent material. Conversely, if absorbent material A has a shorter absorption time, it means that the liquid permeability of the diffusion sheet is lower than that of the absorbent material.

[0038]

[1-1a] Absorbent Material:

The absorbent material absorbs and retains the wearer's urine. The absorbent material is composed of a liquid-absorbing material because of the need to absorb and retain the wearer's urine and other bodily fluids.

[0039]

The absorbent material is inserted between the top sheet and the back sheet and secured between the top sheet and the back sheet by sealing the perimeter of the top sheet and the back sheet. Accordingly, a flap portion is formed on the periphery of the absorbent material where the absorbent material is not interposed between the top sheet and the back sheet,

or the edges of the absorbent material are encompassed in at least one of the top sheet and back sheet.

[0040]

In the first absorbent article, the absorbent material is formed with hole portions penetrating from the top surface to the back surface, a top sheet is disposed on the top surface of the absorbent material, and a diffusion sheet with higher liquid permeability than the absorbent material is disposed on the back surface of the absorbent material to cover the region including the openings in the hole portions.

[0041]

The absorbent material is preferably wrapped entirely in a hydrophilic sheet. Such a configuration has the advantage of preventing SAP leakage from the absorbent material and providing shape stability to the absorbent material.

[0042]

There are no particular restrictions on the overall shape of the absorbent material, but the shape can be one used in conventional disposable diapers and other absorbent articles, such as a rectangular, hourglass, gourd, or T-shape.

[0043]

The liquid-absorbing material constituting absorbent materials conventionally used in general absorbent articles such as disposable diapers include fluff pulp, superabsorbent polymers ("SAP" below), and hydrophilic sheets. Wood pulp or non-wood pulp that has been unraveled into a cotton-like material is preferably used as fluff pulp, sodium polyacrylate is preferably used as a SAP, and tissue, absorbent paper, or hydrophilic treated nonwoven fabric is preferably used as a hydrophilic sheet. Synthetic fibers such as thermally bonded fibers may also be included to keep the absorbent material from losing its shape.

[0044]

These liquid-absorbing materials are usually used as single or multi-layered mats. In this case, one of the liquid-absorbing materials mentioned above may be used alone or in combinations of two or more. Among these, a combination of 10 to 500 parts by mass of SAP to 100 parts by mass of fluff pulp is preferred. The SAP may be uniformly mixed in each mat of fluff pulp, or it may be arranged as layers interposed between layers of fluff pulp.

[0045]

The absorbent material may include another diffusion sheet disposed on the top surface side (for example, between the absorbent material and the top sheet) to diffuse liquids such as urine and other bodily fluids (a "top surface-side diffusion sheet" below). When a top surface-side diffusion sheet has been applied and excretory fluid is excreted at a rate greater than the absorption rate of the absorbent material, excretory fluid is temporarily stored and diffused in the top surface-side diffusion sheets. This has the effect of keeping excretory fluid from flowing over the top sheet and leaking when not absorbed in time.

[0046]

The material that constitutes the top surface-side diffusion sheet can be the same as the diffusion sheet placed on the back surface of the absorbent material.

[0047]

There are no particular restrictions on the shape of the hole portions in the absorbent material, as long as they are shaped in such a way that some of the excretory fluid that permeates the top sheet and reaches the absorbent material flows in and excretory fluid that passes through these hole portions permeates into the diffusion sheet. However, the hole portions in the absorbent material are preferably elongated, with the openings in the hole portions extending in the longitudinal direction of the absorbent material.

[0048]

In this configuration, for example, even if excretory fluid flows into the region corresponding to the urination site in a concentrated manner, the fluid is dispersed in the longitudinal direction via the elongated holes. In this way, excretory fluid is effectively prevented from being absorbed in the absorbent material only at the urination site, and excretory fluid can be absorbed over a wider area of the absorbent material.

[0049]

In addition, as mentioned above, by forming hole portions in the longitudinal direction, the absorbent article can be easily bent in the longitudinal direction along the hole portions, making it more likely to conform to the urination site, and improving the fit around the legs. This further improves the leakage prevention effect. In addition, flow of excretory fluid in the width direction of the absorbent material, which is the shortest distance from the urination site to the outside of the absorbent article, can be stopped and excretory fluid can be guided in the longitudinal direction to prevent leakage from the crotch portion.

[0050]

By forming hole portions in the longitudinal direction in this way, excretory fluid can be readily diffused and efficiently absorbed when excretory fluid is absorbed from the back surface of the absorbent material via the diffusion sheet placed on the back surface of the absorbent material.

[0051]

When the absorbent material has a plurality of elongated-shaped hole portions, the width of each hole portion may be the same or different. A single hole portion with a uniform width may be formed in the longitudinal direction, or the width of the hole portion may vary in the longitudinal direction.

[0052]

Although there are no particular restrictions, when the opening in the hole portion has an elongated shape extending in the longitudinal direction of the absorbent material, a width of 5 to 35 mm is preferred, and a width of 10 to 25 mm is even more preferred. If the width of the openings in the hole portions is too narrow, the fit may be reduced when the absorbent material is folded in the hole portions and pressed against the urination site. Also, if the width of the openings in the hole portions is too narrow, excretory fluid may have difficulty passing through the holes. In addition, when the absorbent material becomes worn or

misshapen, or when the absorbent material swells, the area surrounding the hole portions may collapse and the hole portions may become blocked, resulting in a loss of effectiveness. However, if the width of the openings is too wide, the absorbency of the absorbent material at the urination site may decrease and the absorbent material may readily tear at the hole portions.

[0053]

In the first absorbent article 1 shown in Fig. 1 and Fig. 2, three elongated hole portions 15 with openings extending in the longitudinal direction are formed in the width direction of the absorbent material 22 on one longitudinal end of the absorbent material 22. However, there are no restrictions on the number of hole portions 15 and the locations at which they are formed. For example, two elongated hole portions 15 with openings extending in the longitudinal direction may be formed in the width direction of the absorbent material 22 as shown in Fig. 4 and Fig. 5, or a plurality of elongated hole portions 15 with openings extending in the longitudinal direction (three in Fig. 6 and Fig. 7) may be formed in the center of the absorbent material 22 in the width direction as shown in Fig. 6 and Fig. 7. Here, Fig. 4 is a partially cutaway plan view of another embodiment of the first absorbent article of the present invention showing the absorbent article from the top sheet side, and Fig. 5 is a cross-sectional view of the absorbent article in Fig. 4 from line C-C'. Also, Fig. 6 is a partially cutaway plan view of yet another embodiment of the first absorbent article of the present invention showing the absorbent article from the top sheet side, and Fig. 7 is a cross-sectional view of the absorbent article in Fig. 6 from line D-D'. In Fig. 4 to Fig. 7, components that are similar to those in the absorbent article shown in Fig. 1 to Fig. 3 are denoted by the same reference numbers and further description of these components has been omitted.

[0054]

When a plurality of hole portions is formed in the width direction of the absorbent material, the openings in the plurality of hole portions do not have to be parallel. For example, as shown in Fig. 8A, the openings in the hole portions 15 on the edges of the absorbent material 22 may be skewed relative to the central axis in the longitudinal direction. Also, for example, the shape of the openings may be curved instead of straight. For example, in Fig. 8B, the shape of the openings in the hole portions 15 on the edges of the absorbent material 22 is curved (more specifically, arcuate). By using such a configuration, when the first absorbent article is used, for example, as a disposable diaper, gaps are less likely to form around the legs, and leakage from the leg areas can be effectively prevented.

[0055]

In the first absorbent article of the present invention, the hole portions 15 may be formed to hang over at least one end of the absorbent material 22 in the longitudinal direction, as shown in Fig. 9A and Fig. 9B. Fig. 9A shows an example in which a hole portion is formed to hang over at least one end of the absorbent material in the longitudinal direction, and Fig. 9B shows an example of a hole portion formed continuously from one end of the absorbent material to the other end in the longitudinal direction. Here, Fig. 8A, Fig. 8B, Fig. 9A, and Fig. 9B are partially cutaway plan views of embodiments of the absorbent article, showing the absorbent article from the top sheet side. In Fig. 8A, Fig. 8B, Fig. 9A, and Fig. 9B, components that are similar to those in the absorbent article shown in Fig. 1 to Fig. 3 are denoted by the same reference numbers and further description of these components have been omitted.

[0056]

Although not shown in the figures, non-continuous hole portions may be formed to hang over both ends of the absorbent material in the longitudinal direction.

[0057]

The method used to form these hole portions can be incorporated into the forming drum used to form the absorbent material. More specifically, in this method, a protruding portion corresponding to a hole portion is formed in the recessed portion of the forming drum used to shape the absorbent material, and a hole portion is formed in the absorbent material where pulp, etc. is not added.

[0058]

In another method, a hole portion is formed by punching out the portion corresponding to the hole portion after forming the absorbent material without a hole portion.

[0059]

In the method of incorporating hole portions into the forming drum, the hole portions do not have to be removed by punching, and no trimming process is required. However, in the method of forming hole portions by punching, forming hole portions with small openings or complicated shapes is relatively easy.

[0060]

Although the drawings show an example in which a plurality of hole portions are formed and an example in which a single hole portion is formed over the entire length of the longitudinal direction, hole portions may be formed in the absorbent article solely in the region corresponding to the urination site.

[0061]

[1-1b] Diffusion Sheet:

The diffusion sheet used in the first absorbent article of the present invention is disposed on the back surface of the absorbent material to cover the region including the openings in the hole portions formed in the absorbent material. This diffusion sheet has higher liquid permeability than the absorbent material, and when excretory fluid flows into the hole portions of the absorbent material, it can permeate the diffusion sheet and diffuse faster than it can be absorbed by the absorbent material.

[0062]

Such a diffusion sheet can be made of a nonwoven fabric or porous plastic film. The main fibers and resin that constitute the diffusion sheet can be a polyolefin such as polypropylene or polyethylene, a polyamide such as polyester or nylon, an acrylic, vinylon, or composite fibers or a composite resin of these. In the case of a nonwoven fabric, a diffusion sheet can be obtained by forming these fibers using thermal bonding, resin bonding, some other chemical bonding method, needle punching, or the spunlace method. Especially preferred is a bulky carded hot air nonwoven fabric formed using hot air in thermal bonding, or a resin-bonded nonwoven fabric coarsely formed by chemical bonding. The basis weight is

preferably 10 to 50 g/m<sup>2</sup>, and more preferably 20 to 35 g/m<sup>2</sup>. In the case of a porous plastic film, the basis weight is preferably 15 to 60 g/m<sup>2</sup> and more preferably 20 to 45 g/m<sup>2</sup>.

[0063]

The wet strength of the diffusion sheet used in the absorbent material of the present invention is preferably 3.0 N/25 mm or higher and more preferably 6.0 N/25 mm or higher to prevent tearing from the pore portion. The wet strength is measured in accordance with JIS P 8135. For example, crepe paper has a wet strength of less than 2.0 N/25 mm, so when it becomes wet at the hole portions, it may tear from the hole portions.

[0064]

There are no particular restrictions on the width of the diffusion sheet, as long as it is wide enough to cover the region including the openings in the hole portions formed in the absorbent material. In the absorbent article 1 shown in Fig. 1 to FIG. 3, the absorbent material 22 is hourglass-shaped, and a rectangular diffusion sheet 23 of the same width as the narrowest part of the absorbent material 22 (that is, the waist of the hourglass shape). However, the diffusion sheet 23 may be of the same width as the absorbent material 22 as shown in Fig. 10A, or the diffusion sheet 23 may be wider than the absorbent material 22 as shown in Fig. 10B. Fig. 10A and Fig. 10B are cross-sectional views showing other embodiments of the absorbent article of the present invention. In Fig. 10A and Fig. 10B, components that are similar to those in the absorbent article shown in Fig. 1 to Fig. 3 are denoted by the same reference numbers and further description of these components has been omitted.

[0065]

In an absorbent article of the present invention, the width of the diffusion sheet should be 80% or less of the width of the absorbent material at the urination site. For example, if a diffusion sheet is disposed over the entire width direction of the absorbent material, excretory fluid may be diffused by the diffusion sheet beyond the side edges of the absorbent material to areas where no absorbent material is present. This configuration also reduces the amount of relatively expensive diffusion sheet used, making the absorbent article less expensive. The diffusion sheet should be at least 50% of the width, and more preferably at least 65% of the width, of the absorbent material at the urination site. For example, if the width of the diffusion sheet is less than 50% of the width of the absorbent material at the urination site, the excretory fluid may not be sufficiently diffused and the absorption rate for excretory fluid may decrease.

[0066]

The diffusion sheet may be disposed over the entire longitudinal direction of the absorbent material or disposed only partially in this direction. There are no particular restrictions on the length of the diffusion sheet in the longitudinal direction, as long as it is long enough to cover the region including the openings in the hole portions formed in the absorbent material. The length of the diffusion sheet is preferably at least 35% of the length of the absorbent material and more preferably at least 50% of the length. This configuration covers the urination site and allows for good diffusion of excretory fluid in the longitudinal direction, as well as a sufficient increase in the absorption rate.

[0067]

The diffusion sheet may of course be arranged to cover the entire longitudinal region of the absorbent material. Because this configuration enables the diffusion sheet to be positioned so as to cover the region including the openings in the hole portions formed in the absorbent material without having to align the diffusion sheet during production, absorbent articles can be produced more easily.

[0068]

When a porous plastic film is used as a diffusion sheet, the shape of the pores in the porous plastic film should be funnel-shaped, that is, the size of the opening in the pores decreases progressively from the front surface to the back surface of the porous plastic film. This configuration allows excretory fluid to pass through the pores of the porous plastic film and reduces liquid backflow.

[0069]

There are no particular restrictions on the thickness of the diffusion sheet. For example, when a porous plastic film is used as the diffusion sheet, the thickness is preferably from 200 to 1500  $\mu\text{m}$ , and more preferably from 350 to 1200  $\mu\text{m}$ .

[0070]

Porous plastic films with a large pore size are usually excellent for diffusion of excretory fluids, but when disposed directly under the top sheet, liquid tends to remain in the non-porous top sheet, resulting in an unsatisfactory dry feeling on the top surface. Because the first absorbent article of the present invention is composed of hole portions in the absorbent material and a diffusion sheet on the back surface of the absorbent material so as to cover the hole portions, and because the diffusion sheet is disposed over a sufficient area with respect to the absorbent material but isolated from the top sheet or in contact with the top sheet only in a limited area, liquid remaining in the top sheet is reduced and sufficient diffusion can be realized.

[0071]

The diffusion sheet disposed on the back surface of the absorbent material may be colored. The use of a colored diffusion sheet makes the hole portions in the absorbent material easier to see from the top sheet side and makes it easier to bend the absorbent material along the hole portions when a wearer is using the absorbent material.

[0072]

When the diffusion sheet 23 is of the same width as the absorbent material 22, as shown in Fig. 10A, for example, the diffusion sheet can be positioned so as to cover the region including the openings in the hole portions formed in the absorbent material without having to align the diffusion sheet during production, and absorbent articles can be produced more easily.

[0073]

When the diffusion sheet 23 is wider than the absorbent material 22, as shown in Fig. 10B, for example, when excretory fluid flows out from the side edges of the absorbent material, the diffusion sheet can catch this outflow and diffuse it to the back surface of the absorbent material, effectively preventing leakage.

[0074]

[1-2] Second Absorbent Article:

An embodiment of the second absorbent article of the present invention will now be described in detail. As shown in Fig. 11 and Fig. 12, the second absorbent article of the present invention is an absorbent article 61 comprising an absorbent material 62, a top sheet 18 made at least partially of a liquid-permeable material and disposed so as to cover the top surface of the absorbent material 62, and a back sheet 20 made of a liquid-impermeable material and disposed on the back surface of the absorbent material 62. In this absorbent article 61, the absorbent material 62 has a first absorbent material 62a and a second absorbent material 62b, a hole portion 65 that penetrates from the top surface to the back surface of the first absorbent material 62a is formed in the first absorbent material 62a, the top sheet 18 is disposed on the top surface of the first absorbent material 62a, and a diffusion sheet 63 with higher liquid permeability than the first absorbent material 62a is disposed between the first absorbent material 62a and the second absorbent material 62b so as to cover the region including the opening in the hole portion 65 in the first absorbent material 62a.

[0075]

Specifically, the second absorbent article of the present invention is provided with another absorbent material (the second absorbent material in the second absorbent article) on the back surface side of the diffusion sheet of the first absorbent article. This configuration provides the same effects as the first absorbent article described above. In addition, the second absorbent article of the present invention can increase the absorbency of the entire absorbent material and can absorb excretory fluid that reaches the diffusion sheet from the hole portion of the first absorbent material at the back surface of the first absorbent material and the top surface of the second absorbent material. This can further increase the excretory fluid absorption rate and effectively prevent leakage of excretory fluid.

[0076]

Fig. 11 is a partially cutaway plan view of an embodiment of the second absorbent article of the present invention showing the second absorbent article from the top sheet side. Fig. 12 is a cross-sectional view of the second absorbent article in Fig. 11 from line E-E'.

[0077]

[1-2a] First Absorbent Material:

The first absorbent material used in the second absorbent article of the present invention has a hole portion penetrating from the top surface to the back surface of the first absorbent material. A top sheet is disposed on the top surface of this first absorbent material, and a diffusion sheet with higher liquid permeability than the first absorbent material is disposed between the first absorbent material and the second absorbent material, that is, on the back surface of the first absorbent material, so as to cover the region including the opening in the hole portion formed in the first absorbent material.

[0078]

The first absorbent material can be configured in the same way as the absorbent material in the first absorbent article described above. The configuration of the hole portions in the first absorbent material should be the same as those of the hole portions in the first absorbent article.

[0079]

[1-2b] Second Absorbent Material:

As shown in Fig. 11 and Fig. 12, the second absorbent material 62b used in the second absorbent article 61 of the present invention is an absorbent material disposed on the back surface of the diffusion sheet 63 disposed on the first absorbent material 62a.

[0080]

The first absorbent material and the second absorbent material used in the second absorbent article of the present invention may be made of the same or different liquid-absorbing materials. Specifically, synthetic fibers, such as thermally bonded fibers, may be mixed into one of the first absorbent materials and the second absorbent material to prevent mold collapse. Also, increasing the ratio of superabsorbent polymers compared to the first absorbent material is an effective way of creating a second absorbent material, which is some distance in the thickness direction from the top sheet side, to serve as an absorbent material for storing excretory fluid. This configuration can reduce the uneven distribution of excretory fluid in the first absorbent material, making liquid less likely to backflow when body pressure is applied. For example, if the configuration is the opposite of what was described above, that is, if the ratio of superabsorbent polymer in the first absorbent material near the top sheet side is higher, polymer leakage may occur from the top sheet.

[0081]

While the absorbent article 61 shown in Fig. 11 and Fig. 12 is made by laminating the first absorbent material 62a and the second absorbent material 62b with a diffusion sheet 63 interposed between the first absorbent material 62a and the second absorbent 62b material. For example, as shown in Fig. 13, the first absorbent material 62a and the second absorbent material 62b may be joined together along some or all of their outer edges. This configuration allows for good absorption of excretory fluid by the first absorbent material 62a and the second absorbent material 62b.

[0082]

While not shown in the figures, the absorbent material is generally wrapped on the back surface and side surfaces with a hydrophilic sheet serving as a carrier to prevent leakage of superabsorbent polymer and to prevent deformation of the absorbent material on the production line. The absorbent article of the present invention may have the first absorbent material or second absorbent material wrapped in such a hydrophilic sheet. The absorbent material may be entirely wrapped in a hydrophilic sheet, or a portion of the absorbent material may be wrapped in a hydrophilic sheet.

[0083]

In Fig. 12 and Fig. 13, the first absorbent material 62a and the second absorbent material 62b are of similar size. However, for example, as shown in Fig. 14A and Fig. 14B, the first

absorbent material 62a and the second absorbent material 62b may be of different sizes. Fig. 14A shows an example in which the second absorbent material 62b is smaller than the first absorbent material 62a and the second absorbent material 62b is as large as the diffusion sheet 63 disposed on the back surface of the first absorbent material 62a. Fig. 14B shows an example in which the second absorbent material 62b is smaller than the first absorbent material 62a and the second absorbent material 62b is larger than the diffusion sheet 63 disposed on the back surface of the first absorbent material 62a. The second absorbent material may of course be larger than the first absorbent material.

[0084]

In the absorbent articles shown in Fig. 14A and Fig. 14B, the top sheet 18 covers the top surface of the first absorbent material 62a, the inner surfaces of the hole portions 65 in the first absorbent material 62a, and the diffusion sheet 63 is exposed in the hole portions 65, and the top sheet 18 and the diffusion sheet 63 are joined together at the openings in the hole portions 65 on the back surface of first absorbent material 62a. The top sheet and diffusion sheet may be bonded directly or via the hydrophilic sheet in which the absorbent material is wrapped.

[0085]

In addition, the second absorbent material may be, for example, as shown in Fig. 15, wrapped in the hydrophilic sheet 51 together with the diffusion sheet 63 disposed on the back surface of the first absorbent material 62a (that is, the surface side of the second absorbent material 62b), except for the region corresponding to the openings in the hole portions 65 formed in the first absorbent material 62a. This configuration has the advantage of keeping SAP from leaking from the second absorbent material without impeding permeation of excretory fluid from the hole portions to the diffusion sheet and providing shape stability to the second absorbent material.

[0086]

In the absorbent article 61 shown in Fig. 15, the diffusion sheet 63 is disposed directly under the top sheet in the hole portion, but the hydrophilic sheet 51 may be disposed on the top surface or back surface of the diffusion sheet 63. In Fig. 15, the diffusion sheet 63 is wrapped in the hydrophilic sheet 51 together with the second absorbent material 62b, but it may be disposed on the top surface of the second absorbent material wrapped in the hydrophilic sheet.

[0087]

In the absorbent article of the present invention, the second absorbent material may also have hole portions penetrating from the top surface to the back surface of the second absorbent material (the "second hole portions" below). This configuration allows the second absorbent material to be folded at the second hole portions to further improve the fit.

[0088]

When forming the second hole portions 66 in the second absorbent material 62b, the second hole portions 66 may be formed at the same locations as the hole portions 65 in the first absorbent material 62a as shown in Fig. 16A, or the hole portions 65 in the first absorbent material 62a and the second hole portions 66 in the second absorbent material 62b may be formed in different locations as shown in Fig. 16b.

[0089]

Although there are no particular restrictions on the shape of the opening in the second hole portions, when the openings in the second hole portions have an elongated shape extending in the longitudinal direction of the absorbent material, as in the case of the hole portions in the first absorbent material ("first hole portions" below), a width of 5 to 35 mm is preferred, and a width of 10 to 25 mm is more preferred. The first hole portions and second hole portions may have the same or different lengths in the width direction of the absorbent material (the width of the hole portions below). For example, in the first absorbent material, the width of the first hole portions may be made wider so that the flow rate is fast and a relatively large amount of excretory fluid can pass through, while in the second absorbent material, the width of the second hole portions may be made narrower than the width of the first hole portions, because excretory fluid diffused by the diffusion sheet passes through at a slower flow rate.

[0090]

When the first hole portions 65 in the first absorbent material 62a and the second hole portions 66 in the second absorbent material 62b are formed in the same positions, as in Fig. 16A, excretory fluid reaches the back surface side of the second absorbent material 62b relatively easily, making it more effective at absorbing excretory fluid from the back surface of the second absorbent material as well. The hole portions (first and second hole portions) may be configured so that the positions of some of the hole portions are the same and others are different. When the hole portions are configured to be partially in the same positions, it is easy to bend the absorbent article at the hole portions, and the absorbent article can be bent to conform to the wearer's body and hug the urination site.

[0091]

When the first hole portions 65 in the first absorbent material 62a and the second hole portions 66 in the second absorbent material 62b are formed in different positions, as in Fig. 16B, the retention time for excretory fluid in the diffusion sheet 63 disposed on the back surface of the first absorbent material 62a is longer, and the volume of liquid absorbed from the back surface of the first absorbent material 62a and the top surface of the second absorbent material 62b can be increased.

[0092]

The positioning of the first hole portions and the second hole portions is preferably at least partially different. For example, if all of the hole portions are in the same positions in the first absorbent material and the second absorbent material, the top sheet, diffusion sheet, and back sheet may be laminated without any absorbent material disposed in the regions corresponding to the hole portions at all, and the hole portions may be easily blocked by deformation. Also, by making the positions of the first hole portions and second hole portions at least somewhat different, the absorbent article can be made moderately firm when the absorbent article is folded, making it easier to stabilize the shape of the absorbent article and improve its fit.

[0093]

The first hole portions and second hole portions may be formed so that they are in the same positions near the center of the width direction, which is the urination site, and only partially

aligned in terms of position on the side edges. This configuration makes it easier to bend the center in the width direction, which is the urination site, and easier to get the absorbent material to conform to the wearer. Meanwhile, the hole portions formed on the side edges allow the side edges to bend moderately, further improving the fit.

[0094]

While not depicted in the figures, in the second absorbent article of the present invention, the absorbent may have a laminated structure with three or more layers. In such a laminated structure, the first absorbent material with hole portions (the first hole portions) is disposed on the uppermost layer of the absorbent material so that it is located on the wearer's skin.

[0095]

For example, in the second absorbent article 61 shown in Fig. 12, the diffusion sheet 63 disposed on the first absorbent material 62a is smaller than the width of the absorbent material 62. Also, as shown in Fig. 17, the diffusion sheet 63 may be as large as the width of the first absorbent material 62a and the second absorbent material 62b.

[0096]

In addition, as shown in Fig. 18, for example, the diffusion sheet 63 disposed on the back surface of the first absorbent material 62a may cover the entire second absorbent material 62b. In this configuration, excretory fluid that permeates the diffusion sheet 63 is absorbed not only from the back surface of the first absorbent material 62a and the top surface of the second absorbent material 62b, but also from the side surfaces and back surface of the second absorbent material 62b, and this is especially effective when the volume of excretory fluid is large. Also, because excretory fluid, once absorbed on the back surface of the first absorbent material 62a and the top surface of the second absorbent material 62b, gradually diffuses through the diffusion sheet 63 to regions with relatively low absorption volumes, the absorbency of the absorbent material in the region near the hole portions 65 is less likely to become saturated and can be used successfully for a long period of time without leaking.

[0097]

In Fig. 18, the diffusion sheet is disposed so as to cover the entire second absorbent material. For example, while not depicted in the figures, the diffusion sheet may cover at least the top surface and side edges of the second absorbent material and may be positioned so that a gap can form in the center of the back surface of the second absorbent material, and the side edges of the diffusion sheet may be positioned so that they overlap after the entire second absorbent material is covered.

[0098]

[1-2c] Diffusion Sheet:

The diffusion sheet used in the second absorbent article of the present invention can be configured in the same way as the diffusion sheet used in the first absorbent article of the present invention described above.

[0099]

[1-3] Third Absorbent Article:

An embodiment of the third absorbent article of the present invention will now be described in detail. As shown in Fig. 19 and Fig. 20, the third absorbent article of the present invention is an absorbent article 71 comprising an absorbent material 72, a top sheet 18 made at least partially of a liquid-permeable material and disposed so as to cover the top surface of the absorbent material 72, and a back sheet 20 made of a liquid-impermeable material and disposed on the back surface of the absorbent material 72. In this absorbent article 71, the absorbent material 72 has a first absorbent material 72a and a second absorbent material 72b, a hole portion 75 that penetrates from the top surface to the back surface of the first absorbent material 72a is formed in the first absorbent material 72a (the "first hole portion" below), a hole portion 76 that penetrates from the top surface to the back surface of the second absorbent material 72b is formed in the second absorbent material 72b (the "second hole portion" below), the top sheet 18 is disposed on the top surface of the first absorbent material 72a, a first diffusion sheet 73 with higher liquid permeability than the first absorbent material 72a is disposed between the first absorbent material 72a and the second absorbent material 72n so as to cover the region including the opening in the first hole portion 75 of the first absorbent material 72a, and a second diffusion sheet 74 with higher liquid permeability than the second absorbent material 72b is disposed on the back surface of the second absorbent material 72b so as to cover the region including the opening in the second hole portion 76 in the second absorbent material 72b.

[0100]

In other words, the third absorbent article has another absorbent material (the second absorbent material in the third absorbent article) with a second hole portion penetrating from the top surface to the back surface on the back surface side of the diffusion sheet of the first absorbent article described above, and a second diffusion sheet with higher liquid permeability than the second absorbent material is arranged so as to cover the region including the opening in the second hole portion formed in this second absorbent material. In this configuration, the same effects as those of the first and second absorbent articles described above can be obtained. In addition, the third absorbent article of the present invention can increase the absorbency of the absorbent material as a whole, and because the excretory fluid that reaches the first diffusion sheet from the hole portion in the first absorbent material is absorbed on the back surface of the first absorbent material and the top surface of the second absorbent material, and the excretory fluid that reaches the second diffusion sheet from the second hole portion in the second absorbent material can be absorbed on the back surface of the second absorbent material, the excretory liquid absorption rate can be increased further and leakage of excretory fluid prevented more effectively.

[0101]

Fig. 19 is a partially cutaway plan view of an embodiment of the third absorbent article of the present invention showing the absorbent article from the top sheet side. Fig. 20 is a cross-sectional view of the third absorbent article in Fig. 19 from line F-F'.

[0102]

[1-3a] First Absorbent Material:

The first absorbent material used in the third absorbent article of the present invention has hole portions penetrating from the top surface to the back surface of the first absorbent material. A top sheet is disposed on the top surface of the first absorbent material, and a first diffusion sheet with higher liquid permeability than the first absorbent material is disposed between the first absorbent material and the second absorbent material, that is, on the back surface of the first absorbent material, so as to cover the region including the openings in the hole portions formed in the first absorbent material.

[0103]

The first absorbent material can be configured in the same way as the first absorbent material in the second absorbent article described above. The configuration of the hole portions in the first absorbent material should be similar to the hole portions in the second absorbent material.

[0104]

[1-3b] Second Absorbent Material:

The second absorbent material used in the third absorbent article of the present invention is an absorbent material disposed on the back surface of the first diffusion sheet 73 disposed on the first absorbent material 72a, as shown in Fig. 19 and Fig. 20. The second absorbent material used in the third absorbent article can be constructed in the same way as the second absorbent material used in the second absorbent article described above, as long as the second absorbent material has second hole portions penetrating from the top surface to the back surface.

[0105]

The first absorbent material and the second absorbent material used in the third absorbent article of the present invention may be similar or different in terms of the liquid absorbing material used, as in the second absorbent article described above.

[0106]

In Fig. 19 and Fig. 20, the first absorbent material 72a and the second absorbent material 72b are the same size, but the first absorbent material and the second absorbent material may be different sizes.

[0107]

In Fig. 19 and Fig. 20, the first hole portions 75 in the first absorbent material 72a and the second hole portions 76 in the second absorbent material 72b are formed in the same positions. However, for example, as shown in Fig. 21, the first hole portions 75 in the first absorbent material 72a and the second hole portions 76 in the second absorbent material 72b may be formed in different locations. Fig. 21 is a cross-sectional view showing another embodiment of the third absorbent article of the present invention. In Fig. 21, components that are similar to those in the absorbent article shown in Fig. 19 to Fig. 20 are denoted by the same reference numbers and further description of these components has been omitted.

[0108]

[1-3c] First Diffusion Sheet:

The first diffusion sheet used in the third absorbent article of the present invention can be configured in the same way as the diffusion sheet used in the first absorbent article of the present invention described above.

[0109]

[1-3d] Second Diffusion Sheet:

The second diffusion sheet used in the third absorbent article of the present invention is a diffusion sheet that is disposed on the back surface of the second absorbent material to cover the region including the openings in the second hole portions in the second absorbent material. This second diffusion sheet can be configured in the same way as the diffusion sheet used in the first absorbent article of the present invention described above.

[0110]

In the third absorbent article, the first diffusion sheet and the second diffusion sheet may be diffusion sheets made of the same or different liquid absorbing materials.

[0111]

For example, use of a diffusion sheet made of a material with higher liquid permeability, that is, higher diffusion capacity, is preferred for the first diffusion sheet, which is positioned close to the top sheet, because excretory fluid may become concentrated locally and flow into the sheet. For example, a bulky nonwoven fabric can be used as one of the first and second diffusion sheets, and a resin bonded nonwoven fabric can be used as the other diffusion sheet. In this way, sheets with different production methods can be used according to their different characteristics.

[0112]

Diffusion sheets made of different materials can also be used, for example, a nonwoven fabric as one diffusion sheet and a porous plastic film as the other. For example, if there is no body pressure exerted on the absorbent article, a bulky nonwoven fabric may be used as a diffusion sheet to diffuse excretory fluid at high speed, but if body pressure is exerted on the absorbent article, the material for the diffusion sheet may be selected according to the usage conditions of the absorbent material, such as a porous plastic film to prevent diffusion, etc.

[0113]

The second diffusion sheet may be the same size as the first diffusion sheet disposed on the back surface of the first absorbent material, or it may be of a different size, as long as it covers the region including the openings in the second hole portions in the second absorbent material. When the size of the first diffusion sheet and the second diffusion sheet are different, initial diffusion of excretory fluid can be promoted by making the first diffusion sheet on the side closer to the top sheet larger, increasing the excretory fluid absorption rate.

[0114]

In addition, the absorbent article of the present invention may have more than three sheets of absorbent material, an absorbent material (for example, the third absorbent material) may be disposed on the back surface of the second diffusion sheet, a hole portion may be formed in this other absorbent material (the third absorbent material), and another diffusion sheet (for example, a third diffusion sheet) may be disposed on the back surface of this other absorbent material (the third absorbent material).

[0115]

[1-4] Common Elements of the Absorbent Articles (First to Third Absorbent Articles) of the Present Invention:

The following is a description of the elements common to the absorbent articles (first to third absorbent articles) of the present invention.

[0116]

[1-4a] Top Sheet:

The top sheet is a sheet disposed so as to cover the top surface of the absorbent material (or the surface located on the wearer's skin side when the absorbent article is used as a disposable diaper). The top sheet is at least partially (wholly or partially) made of liquid-permeable material because the absorbent material placed on its back surface must be able to absorb the wearer's urine.

[0117]

For example, a woven fabric, nonwoven fabric, or porous film can be used as the liquid-permeable materials constituting the top sheet. Among these, use of a nonwoven fabric made of a thermoplastic resin such as polypropylene, polyethylene, polyester, or nylon subjected to hydrophilic treatment is preferred. The top sheet may be composed of a single sheet of material or multiple sheets of material.

[0118]

In the absorbent articles (first to third absorbent articles) of the present invention, the top sheet may be disposed along the surface of the absorbent material (first absorbent material), for example, to cover the openings on the top surface side of the hole portions 15 formed in the absorbent material 22 as shown in Fig. 2. However, in the first absorbent article, the top sheet may, for example, cover the top surface of the absorbent material, the inner surface of the hole portion in the absorbent material, and the diffusion sheet exposed in the hole portions, and the top sheet and diffusion sheet may be joined together at the openings in the hole portions on the back surface of the absorbent material. Also, in the second absorbent article of the present invention, the top sheet may cover the top surface of the first absorbent material, the inner surface of the hole portions in the first absorbent material, and the diffusion sheet exposed by the hole portions (the first diffusion sheet in the third absorbent article), and the top sheet and the diffusion sheet (first diffusion sheet) may be joined together at the openings in the hole portions on the back surface of the first absorbent material.

[0119]

For example, Fig. 22 shows the first absorbent article 1 in which the top sheet 18 covers the top surface of the absorbent material 22, the inner surface of the hole portions 15 in the absorbent material 22, and the diffusion sheet 23 exposed in the hole portions 15, and the top sheet 18 and the diffusion sheet 23 are joined together at the openings in the hole portions 15 on the back surface of absorbent material 22. Also, Fig. 23 shows the second absorbent article 61 in which the top sheet 18 covers the top surface of the first absorbent material 62a, the inner surface of the hole portions 65 in the first absorbent material 62a, and the diffusion sheet 63 exposed in the hole portions 65, and the top sheet 18 and the diffusion sheet 63 are joined together at the openings in hole portions 65 on the back surface of first absorbent material 62a.

[0120]

This configuration makes it easier for the absorbent material to bend along the hole portions, further improving the fit to the wearer. Also, because excretory fluid that permeates the top sheet disposed in the hole portions directly permeates the diffusion sheet (the first diffusion sheet in the third absorbent article), the diffusion sheet can diffuse more excretory fluid, further improving the excretory fluid absorption rate. This can also effectively prevent the hole portions from losing their shape.

[0121]

Fig. 22 is a cross-sectional view showing another embodiment of the first absorbent article of the present invention, and Fig. 23 is a cross-sectional view showing another embodiment of the second absorbent article of the present invention. In Fig. 22 to Fig. 23, components that are similar to those in the absorbent article shown in Fig. 2 to Fig. 12 are denoted by the same reference numbers and further description of these components has been omitted.

[0122]

Also, even in an absorbent article 61 such as the one shown in Fig. 15 in which the second absorbent material 62b is wrapped in a hydrophilic sheet 51, except in the region corresponding to the openings in the hole portions 65 in the first absorbent material 62a, as shown in Fig. 24, the top sheet 18 may cover the inner surface of the hole portions 65 of the first absorbent material 62a and the diffusion sheet 63 exposed in the hole portions 65, and the top sheet 18 and the diffusion sheet 63 may be joined together at the openings in the hole portions 65 on the back surface of the first absorbent material 62a. This configuration can realize the same effects as the absorbent articles shown in Fig. 22 and Fig. 23. In these drawings, the diffusion sheet is wrapped in a hydrophilic sheet, but the diffusion sheet may be disposed on top of a hydrophilic sheet.

[0123]

[1-4b] Back Sheet:

The back sheet is a sheet disposed so as to cover the back surface of the absorbent material, for example, the surface located on the wearer's clothed side when the absorbent article is used as a disposable diaper. The back sheet is composed of a liquid-impermeable material to prevent leakage of excretory fluid such as urine to the outside.

[0124]

Liquid-impermeable material constituting the back sheet can be, for example, a liquid-impermeable film made of resins such as polyethylene. Among these, a microporous polyethylene film is preferred. The microporous polyethylene film has many pores of 0.1 to several  $\mu\text{m}$  in size, and although it is impermeable to liquid, it has moisture permeability, which confers the advantage of preventing, for example, stuffiness inside a disposable diaper.

[0125]

Also, in the second absorbent article of the present invention, for example, as shown in Fig. 25, the back sheet 20 may cover the back surface of the second absorbent material 62b, the inner surface of the second hole portions 66 of the second absorbent material 62b, and the diffusion sheet 63 exposed in the second hole portions 66 on the top surface side of the second absorbent material 62b, and the back sheet 20 and the diffusion sheet 63 may be joined together at the openings in the second hole portions 66 on the top surface side of the second absorbent material 62b. This configuration makes it easier for the absorbent material to bend along the second hole portions, further improving the fit to the wearer. This can also effectively keep the second hole portions from losing their shape.

[0126]

When the absorbent article of the present invention is used as a disposable diaper, this back sheet may be laminated with a sheet material (cover sheet) on the outermost surface side. This cover sheet is used to reinforce the back sheet and provide a good feel (tactile feel) to the back sheet.

[0127]

A woven or nonwoven fabric, for example, can be used as material for the cover sheet. Among these, dry and wet nonwoven fabrics made of thermoplastic resins such as polyethylene, polypropylene, and polyester are preferred.

[0128]

[2] Disposable Diaper:

Next, an embodiment of the absorbent article of the present invention as a disposable diaper will be described. The absorbent articles can be used in a disposable diaper such as a tape-style diaper, a pants-style diaper, or in a urine pad. The following is an example of a one-piece tape-style diaper.

[0129]

In the present specification, a "tape-style diaper" refers to a diaper with an absorbent material 22, a top sheet 18 at least partially made of a liquid-permeable material, and a back sheet 20 made of a liquid-impermeable material, as in the tape-style diaper 100 shown in Fig. 26. This style of disposable diaper also has a front piece 2, a crotch portion 4, and a rear piece 6, with fastening tape 7 extending from the left and right-side edges 6a, 6b of the rear piece 6 to secure the rear piece 6 to the front piece 2.

[0130]

In the present specification, a "pants-style diaper" refers to a diaper that is configured as pants by joining together the opposing side edges (side edges 2a, 6a and 2b, 6b) of front piece 2 and rear piece 6 to form joined portions 8, a waist opening 10, and a pair of leg openings 12a, 12b as in the pants-style diaper 110 shown in Fig. 27.

[0131]

A "one-piece type diaper" differs from the two-piece type diaper described below, and refers to a diaper that has a top sheet, back sheet, and absorbent material, but an absorbent material with a liquid absorbing and retaining function is interposed (built in) between the top sheet and the back sheet, and is integrally constructed with the top sheet and/or back sheet, which are responsible for the wearing function.

[0132]

In the present specification, "front piece" refers to the portion covering the wearer's abdomen (front of the body) when the diaper is worn on the wearer, the "crotch portion" refers to the portion covering the wearer's crotch when the diaper is worn on the wearer, and "rear piece" refers to the portion covering the wearer's back side (rear of the body) when the diaper is worn on the wearer.

[0133]

#### [2-1] Configuration of a Tape-Style Diaper:

The tape-style diaper that is an embodiment of the absorbent article of the present invention has an absorbent material configured in the same manner as the absorbent materials in the first to third absorbent articles described above.

[0134]

This tape-style diaper comprises a first absorbent article in which an absorbent material is formed with hole portions that penetrate from the top surface to the back surface, a top sheet is disposed on the top surface of the absorbent material, and a diffusion sheet with higher liquid permeability than the absorbent material disposed on the back surface of the absorbent material to cover the regions including the openings in the hole portions, or, as in the second absorbent article, a first absorbent material in which an absorbent material is formed with hole portions that penetrate from the top surface to the back surface, a second absorbent material with hole portions penetrating from the top surface to the back surface and disposed on the back surface of the first absorbent material, a top sheet disposed on the top surface of the first absorbent material, and a diffusion sheet with higher liquid permeability than the first absorbent material disposed between the first absorbent material and the second absorbent material to cover the region including the openings in the hole portions of the first absorbent material, or, as in the third absorbent article, a first absorbent material in which an absorbent material is formed with hole portions that penetrate from the top surface to the back surface, a second absorbent having hole portions penetrating from the top surface to the back surface and disposed on the back surface of the first absorbent material, a top sheet disposed on the top surface of the first absorbent material, a first diffusion sheet with higher liquid permeability than the first absorbent material disposed between the first absorbent material and the second absorbent material to cover the region including the openings in the hole portions in the first absorbent material, and a second diffusion sheet with higher liquid permeability than the second absorbent material disposed

on the back surface of the second absorbent material to cover the region including the openings in the hole portions in the second absorbent material.

[0135]

The tape-style diaper shown in Fig. 26 has the same configuration as the first absorbent article, that is, an absorbent material 22 with hole portions 15 that penetrate from the top surface to the back surface, a top sheet 18 disposed on the top surface of the absorbent material 22, and a diffusion sheet 23 that is more permeable to liquid than the absorbent material 22 disposed on the back surface of absorbent material 22 so as to cover the region including the openings in the hole portions 15.

[0136]

The tape-style diaper of this embodiment has excellent excretory liquid absorbency and good fit to the wearer. In other words, excretory fluid such as urine is absorbed at the urination site in the absorbent material (the first absorbent material in the second and third absorbent articles), some of the excretory fluid passes through the hole portions in the absorbent material and permeates into the diffusion sheet (the first diffusion sheet in the third absorbent article), which is more permeable to liquid than the absorbent material, and the excretory fluid is absorbed from the back surface of the absorbent material through the diffusion sheet. In this way, excretory fluid is absorbed over a larger area, resulting in superior absorbency.

[0137]

Also, in the tape-style diaper of this embodiment, by forming hole portions in the absorbent material with an elongated shape in the longitudinal direction of the absorbent material, the hole portions make it easier for the absorbent material to bend and conform to the wearer's excretion site, improving the fit to the wearer. Also, because the absorbent material is bent at the hole portions, gaps are less likely to occur around the legs, effectively preventing liquid leakage from the leg areas (or "side leakage").

[0138]

The absorbent material, top sheet, and back sheet constituting the tape-style diaper in this embodiment can be configured in the same manner as those in the first to third absorbent articles of the present invention described above.

[0139]

In the tape-style diaper in this embodiment, the top sheet may be composed of a single sheet of material or multiple sheets of material. For example, it may consist of a top sheet disposed on the top of the absorbent material and a sheet different from the top sheet disposed in the side flap portions of the diaper. In the tape-style diaper 100 shown in Fig. 26, a top sheet 18 (center sheet 18a) made of a liquid-permeable material is disposed in the center of the diaper, and a top sheet 18 (side sheet 18b) made of a breathable and water-repellent material that exhibits resistance to liquid permeation is disposed on the side flap 5 portions of the diaper.

[0140]

Also, for example, a back sheet may be configured to conform to the external shape of the diaper, or a sheet material (cover sheet) may be applied to the outermost surface side of the back sheet. This cover sheet is used to reinforce the back sheet and provide a good feel (tactile feel) to the back sheet. In the tape-style diaper 100 shown in Fig. 26, the back sheet 20 is disposed in a shape that conforms to the outer shape of the diaper. Also, the back sheet may be disposed at least to the extent that it covers the absorbent material. A disposable diaper with superior air permeability can be configured by using a back sheet that is slightly larger than the absorbent material and by using a cover sheet and side sheets in the side flap portions that are at the wearer's sides. The side flap portions may be made, for example, of a separate nonwoven fabric.

[0141]

In the tape-style diaper 100 of this embodiment, as shown in Fig. 26, the hole portions 15 in the absorbent material 22 are preferably formed at least in the region from the front piece 2 to the crotch portion 4 of the tape-style diaper 100, that is, at the urination site. This configuration provides excellent excretory fluid (urine) absorbency and a good fit to the wearer. It can also effectively prevent excretory fluid from flowing back towards the body.

[0142]

[2-2] Three-Dimensional Gathers:

The tape-style diaper in this embodiment may be provided with three-dimensional gathers to prevent lateral leakage of urine excreted by the wearer. Three-dimensional gathers are components that prevent lateral leakage of urine excreted by the wearer and are leak-proof walls configured to stand up three-dimensionally. By forming three-dimensional gathers, the three-dimensional gathers act as a bulwark to effectively prevent lateral leakage from the leg openings, etc. of the diaper.

[0143]

The configuration of the three-dimensional gathers can be the same as those used in conventional disposable diapers and other absorbent articles. For example, an elastic member (three-dimensional gather elastic member) can be placed in a portion of the water-repellent sheet material and gathers (folds) formed in the sheet material by the three-dimensional gather elastic members.

[0144]

The three-dimensional gathers may be formed from a sheet material completely different from the top sheet and back sheet, or by folding over the top sheet such as a center sheet and side sheets. For example, in the tape-style diaper 100 shown in Fig. 26, these three-dimensional gathers 26 (26a, 26b) are formed by folding a side sheet 18b. However, three-dimensional gathers may be formed by folding a component other than the top sheet, such as the back sheet.

[0145]

These three-dimensional gathers should be formed at least in the crotch portion to prevent leakage from the crotch but may also be formed in the front or back pieces. For example, in the tape-style diaper 100 shown in Fig. 26, a pair of three-dimensional gathers 26 (26a, 26b) are continuously formed in the longitudinal direction of the diaper from the crotch

portion 4 to both the front piece 2 and the rear piece 6. At least one pair of three-dimensional gathers must be formed, but two or more pairs may be formed.

[0146]

The three-dimensional gathers may be inward-facing gathers that incline toward the inside of the diaper or outward-facing gathers that incline toward the outside of the diaper. They can also be three-dimensional gathers (C-fold gathers, Z-fold gathers, etc.) with bent or folded portions formed in parts of the height direction. For example, in the tape-style diaper 100 shown in Fig. 26, the three-dimensional gathers 26 (26a, 26b) are inward-facing gathers.

[0147]

#### [2-3] Fastening Tape:

Fastening tape is used to attach the tape-style diaper to the wearer. There are no particular restrictions on the shape or structure of the diaper, as long as it can be worn by the wearer in tape-style or pants-style diaper form by securing the back and abdomen portions of the diaper to each other.

[0148]

For example, the tape-style diaper 100 shown in Fig. 26 has two strips of fastening tape 7 placed on both edges of the rear piece 6. This fastening tape 7 is configured to be affixable to a front patch 11 located on the outermost surface of the front piece 2. By attaching the fastening tape 7 to the front patch 11, the rear piece 6 and the front piece 2 of the diaper are secured to each other, allowing the diaper to be worn by the wearer.

[0149]

The tape-style diaper 100 shown in Fig. 26 has two strips of fastening tape 7, but the same effect can be realized using a single strip of fastening tape 7 using three or more strips of tape. Two-peak tape with two stop points extending out from the ends of the two strips of fastening tape 7 may also be used.

[0150]

In the present invention, any adhesive tape or mechanical fastener may be used as the fastening tape. Commonly used mechanical fasteners include, for example, protruding members (hook members) with projections (hooks, knobs, anchors, etc.) formed on a surface combined with loop-shaped fibers (loop members) such as a nonwoven fabric composed of staple fibers arranged on a recessed surface. In this type of fastener, the hook members are placed over a surface with the loop members and the numerous projections of the hook member engage the surface of the loop material to firmly adhere both materials to each other in a peelable state.

[0151]

#### [2-4] Elastic Members:

In tape-style diapers, elastic is preferably arranged around the legs and waist portions.

[0152]

A leg surrounding elastic member is an elastic member placed along the leg opening. By placing an elastic member around the legs, gathers (leg gathers) that are very elastic can be formed in the leg openings. In this way, gaps are less likely to form around the legs, effectively preventing liquid leakage from the leg openings. When the elastic is arranged around the legs, the leg elastic contracts on both sides of the absorbent material when the diaper has been changed, causing the region near the crotch to form a bowl-shaped recessed portion. This allows excretory fluids such as urine and bodily fluids to collect in the recessed portion, making it easy to change the diaper without spilling excretory fluids.

[0153]

For example, in the tape-style diaper 100 shown in Fig. 26, leg gathers are formed with two leg surrounding elastic members 40 arranged linearly in the longitudinal direction of the diaper. This leg surrounding elastic 40 is composed of thread elastic. However, the leg surrounding elastic does not have to be arranged linearly. For example, it may be arranged in a curved line along the curves of the leg openings in the diaper.

[0154]

The elastic around the legs is preferably formed in the region outside the standing line 46 of the three-dimensional gathers 26, for example, as in the tape-style diaper 100 shown in Fig. 26. This configuration improves the wearing comfort of the crotch portion while ensuring a sufficient leak-proof effect from the three-dimensional gathers.

[0155]

In the tape-style diaper 100 shown in Fig. 26, the shape, placement position, and number of elastic members 40 around the legs are symmetrical, but an asymmetrical arrangement is also included within the scope of the present invention. In the tape-style diaper 100 shown in Fig. 26, two-leg surrounding elastics 40 are arranged on each side, but one or three or more may also be used. When a plurality of leg elastic members is used, their thickness and elongation ratio can be set based on the intended purpose, and the same material does not have to be used in all of them.

[0156]

A waist-surrounding elastic member is an elastic member placed along the waist opening. By placing an elastic member around the waist, highly elastic gathers (waist gathers) can be formed at the waist opening. The waist gathers make it difficult for gaps to form around the waist, preventing leakage of liquid from the waist area, as well as providing a good fit of the diaper to the wearer and keeping the diaper from sliding down.

[0157]

In the tape-style diaper 100 shown in Fig. 26, a waist surrounding elastic member 42 made of a strip of urethane film is arranged along the edge of the rear piece 6 of the diaper. This waist surrounding elastic member 42 or band may be composed of an elastic foam, such as urethane foam. In the example shown in the figure, a waist surrounding elastic member 42 is placed only on the rear (dorsal) side, but a waist surrounding elastic member may be placed on the front (abdominal) side as well.

[0158]

For these elastic members, the constituent materials, the elongation ratio of the materials, and the state of elongation at the time of fixation should be determined after taking into consideration the degree of contraction in the gathers.

[0159]

Elastic members used in conventional disposable diapers can be used as these elastic members. Specifically, in addition to thread rubber and flat rubber made of natural or synthetic rubber (urethane rubber, etc.), an elastic net, elastic film, or elastic foam (urethane foam, etc.) can be used.

[0160]

The elastic member is preferably fixed in an elongated state in order to exert sufficient elasticity. For example, if the elastic member is made of natural or synthetic rubber, it is preferably fixed at 110 to 400% elongation, and more preferable at 200 to 300% elongation. Fixing the elastic member in this range of elongation allows sufficient elastic force to be applied.

[0161]

The elastic members are fixed to other components of the diaper using an adhesive or other means. Fixing methods include, for example, bonding using hot melt adhesives or other highly fluid adhesives, or fusion by heat sealing or other heat or ultrasonic methods.

[0162]

[2-5] Type-Style Diaper Manufacturing Method:

A method for manufacturing a tape-style diaper that is an absorbent article of the present invention will now be described, using the tape-style diaper 100 shown in Fig. 26 as an example. First, hole portions 15 are formed in the absorbent material used for the tape-style diaper (the absorbent material 22 of the first absorbent article in Fig. 26). Specifically, protruding portions are formed in a recessed portion of a forming drum, which is used to form the shape of the absorbent material, and hole portions are formed in the absorbent material where pulp, etc. is not applied. Alternatively, after forming an absorbent material without hole portions, the hole portions can be punched out using a punch or some other method.

[0163]

Next, the diffusion sheet 23, the absorbent material 22 with the hole portions 15 described above, and leg surrounding elastic members 40 are disposed on the top surface of a long sheet material (back sheet material) serving as the material for the back sheet 20, and a long sheet material (top sheet material) serving as the material for the top sheet 18, is disposed on top of this to obtain a laminate (diaper continuum) serving as the intermediate of the diaper. Here, the diffusion sheet 23 is disposed so as to cover the openings in the hole portions 15 on the back surface side of the absorbent material 22. Two types of top sheet material are used, namely, a top sheet material corresponding to the center sheet 18a and a top sheet material corresponding to the side sheets 18b. The sheet material

corresponding to side sheets 18b has folded portions that form three-dimensional gathers 26.

[0164]

When manufacturing an article with a second absorbent material, for example, as shown in Fig. 12, the second absorbent material is disposed on the back surface of the diffusion sheet. Second hole portions may be formed in this second absorbent material, and a second diffusion sheet may be disposed on the back surface of this second absorbent material.

[0165]

The diaper continuum obtained in this method is cut (R cut) in arc shapes in the portions corresponding to the leg openings in the diaper to form leg openings. Finally, fastening tape 7 is attached and the diaper continuum is cut into individual tape-style diapers 100.

[0166]

In another method, fastening tapes are attached to the top sheet material in advance, a diffusion sheet, absorbent material, and leg surrounding elastic members are disposed on the top surface of the back sheet material, and the top sheet material to which fastening tape has been attached is disposed on top to obtain a diaper continuum. The series of steps described above can be performed continuously by mechanical means. By using a method and equipment for the continuous feeding of long sheet materials from rollers, continuous production of tape-style diapers is possible, which contributes to improved productivity.

[0167]

[2-6] Disposable Diaper Applications:

The disposable diaper that is an absorbent article of the present invention is not limited to one-piece tape-style diapers but can be applied to two-piece tape-style diapers as well. It can also be applied to one-piece and two-piece pants-style diapers. It can also be applied to urine pads that are placed inside the crotch portion of diapers and to other products. By configuring these disposable diapers with an absorbent material and diffusion sheet configured in the same manner as the first to third absorbent articles, the same effects as the one-piece tape-style diaper described above can be obtained.

[0168]

A "two-piece" diaper is a type of diaper that consists of an absorbent material that absorbs and retains excretions from the wearer (absorption and retention function) and an outer component that covers the wearer's body (wearing function). In this type of diaper, an absorbent component is placed inside the outer component.

[0169]

This absorbent component is provided with an absorbent material, a top sheet, and a back sheet, and can be manufactured by interposing the absorbent material between the top sheet and back sheet and sealing the periphery of the absorbent material. The absorbent component is configured at a size that covers at least the crotch portion of the diaper. However, in order to ensure the effectiveness of leakage prevention, it is preferably configured at a size that covers not only the crotch portion but also part of the front piece

and back piece. The absorbent component can be fixed to the outer component using, for example, a hot melt adhesive.

[0170]

The outer component is a component that performs a wearing function in order to cover the wearer's body. Specifically, it is a sheet-like component that forms the front piece, crotch portion, and rear piece. Because the absorbent component in a two-piece tape-style or pants-style diaper is exclusively responsible for the absorption and retention function of absorbing and retaining the wearer's excretory fluids, a liquid-impermeable material does not have to be used as the material that constitutes the outer component. For example, the material that constitutes the outer component can be a nonwoven fabric composed of synthetic fibers made of polyethylene, polypropylene, polyester, or other thermoplastic resin.

[Examples]

[0171]

The present invention will be described in more detail below using examples. However, the present invention is not limited to these examples.

[0172]

(1) Diffusion Sheet Selection:

Because a diffusion sheet with higher liquid permeability than the absorbent material is used in an absorbent article of the present invention, the liquid permeability values of the absorbent materials used in the absorbent articles were compared to those of the diffusion sheets and diffusion sheets were selected.

[0173]

In selecting the diffusion sheets, two absorbent materials (absorbent materials a and b) below were used as the absorbent materials, and three diffusion sheets (diffusion sheets a to c) were used as the diffusion sheets.

[0174]

(Absorbent material a)

Absorbent material consists solely of pulp. The size of absorbent material a was 425 mm × 100 mm, and its basis weight was 200 g/m<sup>2</sup>.

[0175]

(Absorbent material b)

Absorbent material b was an absorbent material composed of pulp etc. and a superabsorbent polymer at a ratio of 30:70. "Pulp etc." refers to components used in absorbent material other than the superabsorbent polymer. The size of absorbent material b was 310 mm × 150 mm, and its basis weight was 350 g/m<sup>2</sup>.

[0176]

(Diffusion sheet a)

A bulky nonwoven fabric (air-permeable nonwoven fabric, "Fuclon P20" from Fukusuke Kogyo) was used as diffusion sheet a. The basis weight of diffusion sheet a is  $19.5 \text{ g/m}^2$ .

[0177]

(Diffusion sheet b)

Diffusion sheet b was a porous film ("AquiDry") from Tredegar, Inc. This porous film was  $1000 \text{ }\mu\text{m}$  thick and had a basis weight of  $36.3 \text{ g/m}^2$ .

[0178]

(Diffusion sheet c)

Tissue was used as diffusion sheet c. The basis weight of the tissue is  $19.5 \text{ g/m}^2$ .

[0179]

(Top sheet, back sheet)

A card embossed nonwoven fabric (Rengo Nonwoven Products, basis weight  $23 \text{ g/m}^2$ ) was used as the top sheet, and a liquid impermeable sheet was used as the back sheet.

[0180]

(1-1) Diffusion Sheet Selection Method:

In the diffusion sheet selection method, absorbent materials a and b alone (test pieces A and B) and an absorbent material with one of diffusion sheets a to c described above disposed on the top surface of the absorbent materials (test pieces C to G) were prepared.

[0181]

Next, the back sheet was disposed on the underside of each absorbent material (test pieces A to G), the top sheet was disposed on the top surface of each absorbent material (test pieces A to G) (on the top surface of the diffusion sheet in test pieces C to G) so that each absorbent material (test pieces A to G) was interposed by a top sheet and a back sheet.

[0182]

After test pieces A to G were interposed between a top sheet and a back sheet, test pieces A to G were allowed to absorb  $100 \text{ ml}$  of saline solution ( $0.9 \text{ mass\% NaCl}$ ) as excretory fluid, and the time required for all of the saline solution to be absorbed by the test pieces A to G (absorption time) was measured. In test pieces C to G on which one of diffusion sheets a to c had been placed, saline solution was absorbed from the top surface of the diffusion sheet.

[0183]

When saline solution was absorbed by test pieces A to G, an absorption rate measuring plate (stainless steel, 100 mm × 100 mm × 8.5 mm, mass 650 g) with a hole portion containing 24 mm diameter openings formed in the center was placed on the top surface of test pieces A to G, saline solution was added dropwise to the hole portion in the absorption rate measuring plate, and the absorption time (seconds) was measured until the saline solution had been absorbed by test pieces A to G and could no longer be seen through the hole portion in the absorption rate measuring plate.

[0184]

The liquid permeability of each diffusion sheet was evaluated by comparing the absorption time (seconds) of absorbent materials a and b alone (test specimens A and B) with the absorption time (seconds) of the test pieces with diffusion sheets on the top surface. If the test pieces with a diffusion sheet placed on the top surface have a shorter absorption time, it means the liquid permeability of the diffusion sheets placed on the top surface is higher than that of the absorbent materials. Conversely, if absorbent materials a and b alone (test pieces A and B) have a shorter absorption time, it means the liquid permeability of the diffusion sheets placed on the top surface is lower than that of the absorbent materials. Table 1 shows the composition of test pieces A to G and the results of the absorption time measurements.

[0185]

[Table 1]

|                                   | Test piece A | Test piece C      | Test piece D      | Test piece E      | Test piece B | Test piece F      | Test piece G      |
|-----------------------------------|--------------|-------------------|-------------------|-------------------|--------------|-------------------|-------------------|
| Absorbent material                | a            | a                 | a                 | a                 | b            | b                 | b                 |
| Diffusion sheet                   | No           | Diffusion sheet a | Diffusion sheet b | Diffusion sheet c | No           | Diffusion sheet a | Diffusion sheet b |
| Amount of saline (ml)             | 100          | 100               | 100               | 100               | 100          | 100               | 100               |
| Absorbency time (sec)             | 130          | 96                | 30                | 132               | 386          | 143               | 35                |
| Evaluation of liquid permeability | -            | High              | High              | Low               | -            | High              | High              |

Diffusion sheet a: Bulky nonwoven fabric (breathable nonwoven fabric)

Diffusion sheet b: Porous film

Diffusion sheet c: Tissue

[0186]

It is clear from Table 1 that the bulky nonwoven fabric (air-porous nonwoven fabric) of diffusion sheet a and the porous film of diffusion sheet b have higher liquid permeability than absorbent materials a and b alone (test pieces A and B). It is also clear that the tissue of diffusion sheet c, when disposed on the top surface of absorbent material a, has an increased absorption time compared to absorbent material a alone, and is less permeable to liquid than the absorbent material.

[0187]

## (2) Absorbency Evaluation of Absorbent Articles (1):

The absorbency of the absorbent articles was evaluated (1) by having the absorbent articles absorb 200 ml of saline solution (0.9 mass% NaCl) simulating excretory fluid and measuring the time required for all of the saline solutions to be absorbed into the absorbent article (absorption time). The absorption rate measuring plate used in the absorption time measuring method was the same one used in the selection of the diffusion sheet described above, and this was used to measure the absorption time (seconds) until the 200 ml of

saline solution (0.9 mass% NaCl) simulating excretory fluid had been absorbed by the absorbent article.

[0188]

In the evaluation of the absorbency of absorbent articles (1), the first absorbent material (1) and the second absorbent material (1) shown below were used as the absorbent materials. When a diffusion sheet is disposed on an absorbent article, the diffusion sheet used was made of the same material as any of diffusion sheets a to c used in the selection of diffusion sheets described above.

[0189]

(First Absorbent Material (1))

The first absorbent material (1) was an absorbent material composed solely of pulp constructed in the same way as absorbent material a used in the selection of diffusion sheets described above. The size of the first absorbent material (1) was 425 mm × 100 mm, which had a basis weight of 200 g/m<sup>2</sup>.

[0190]

(Second Absorbent Material (1))

The second absorbent material (1) was an absorbent material composed of pulp etc. and a superabsorbent polymer at a ratio of 3:2. "Pulp etc." refers to components used in absorbent material other than the superabsorbent polymer. The size of the second absorbent material (1) was 425 mm × 100 mm, which had a basis weight of 600 g/m<sup>2</sup>.

[0191]

(Example 1)

An absorbent material, a top sheet at least partially made of a liquid-permeable material and disposed so as to cover the top surface of the absorbent material, and a back sheet made of a liquid-impermeable material and disposed on the back surface of the absorbent material were used to make the absorbent article.

[0192]

The absorbent material of the absorbent article in the present example has the first absorbent material (1) and the second absorbent material (1) described above, and the first absorbent material (1) has hole portions penetrating from the top surface to the back surface. The bulky nonwoven fabric (air-porous nonwoven fabric) of diffusion sheet a used in the selection of diffusion sheets described above was disposed between the first absorbent material (1) and the second absorbent material (1) to cover the region including the openings in the hole portions of the first absorbent material (1). The size of the openings in the hole portions formed in the first absorbent material (1) was 20 mm × 60 mm. The diffusion sheet was disposed so that it covered the entire back surface of the first absorbent material (1).

[0193]

Card embossed nonwoven fabric (Rengo Nonwoven Products, basis weight 23 g/m<sup>2</sup>) was used as the top sheet, and a liquid impermeable sheet was used as the back sheet.

[0194]

(Example 2)

An absorbent article was made with the same configuration as the absorbent article in Example 1, except that the diffusion sheet disposed between the first absorbent material (1) and the second absorbent material (1) was the porous film of diffusion sheet b used in the selection of diffusion sheets described above.

[0195]

(Comparative Example 1)

An absorbent article was made with the same configuration as the absorbent article in Example 1, except that there was no hole portion in the first absorbent material (1) and the first absorbent material (1) was disposed on the second absorbent material (1) without using a diffusion sheet.

[0196]

(Comparative Example 2)

An absorbent article was made with the same configuration as the absorbent article in Example 1, except that the first absorbent material (1) with hole portions was disposed on the second absorbent material (1) containing hole portions without using a diffusion sheet.

[0197]

(Comparative Example 3)

An absorbent article was made with the same configuration as the absorbent article in Example 1, except that the diffusion sheet disposed between the first absorbent material (1) and the second absorbent materials (1) was the tissue of diffusion sheet c used in the selection of diffusion sheets described above. In the absorbent article of Comparative Example 3, the same combination of absorbent material and diffusion sheet as test piece E in the diffusion sheet selection described above was used.

[0198]

Table 2 shows the configurations of the absorbent articles in Examples 1 and 2 and Comparative Examples 1 to 3 and the results of the absorbency evaluation described above.

[0199]

[Table 2]

|                                             |                         | Ex. 1             | Ex. 2             | C. Ex. 1 | C. Ex. 2 | C. Ex. 3          |
|---------------------------------------------|-------------------------|-------------------|-------------------|----------|----------|-------------------|
| Hole portion in absorbent material (Yes/No) | 1st diffusion sheet (1) | Yes               | Yes               | No       | Yes      | Yes               |
|                                             | 2nd diffusion sheet (1) | No                | No                | No       | No       | No                |
| Diffusion sheet                             |                         | Diffusion sheet a | Diffusion sheet b | No       | No       | Diffusion sheet c |
| Amount of saline (ml)                       |                         | 200               | 200               | 200      | 200      | 200               |
| Absorbency time (sec)                       |                         | 61                | 35                | 102      | 69       | 73                |

[0200]

As shown in Table 2, the absorbent articles in Examples 1 and 2 had saline solution shorter absorption times and better absorbency than the absorbent articles in Comparative Examples 1 and 2. Also, because Comparative Example 3, which is an absorbent article in which a diffusion sheet is disposed in the same manner as the absorbent articles in Examples 1 and 2, uses a diffusion sheet with lower liquid permeability than the first absorbent material, its saline solution absorption time was longer than that of the absorbent article in Comparative Example 2, which did not use a diffusion sheet.

[0201]

### (3) Absorbency Evaluation of Absorbent Articles (2):

The absorbency of the absorbent articles was evaluated (2) by having the absorbent articles absorb 100, 200, or 300 ml of saline solution (0.9 mass% NaCl) as excretory fluid, and measuring the time required for all of the saline solution to be absorbed into the absorbent material (absorption time). The method for measuring absorption time was the same as the one used as in the evaluation of the absorbency of absorbent articles (1) described above.

[0202]

In the evaluation of the absorbency of absorbent articles (2), the first absorbent material (2) and the second absorbent material (2) shown below were used as absorbent materials. When a diffusion sheet was disposed on an absorbent article, a diffusion sheet made of the same material as diffusion sheet a or diffusion sheet b in the selection of diffusion sheets described above was used.

[0203]

#### (First Absorbent Material (2))

The first absorbent material (2) was configured in the same way as absorbent material b used in the selection of the diffusion sheets described above, with a pulp etc. to superabsorbent polymer ratio of 30:70. "Pulp etc." refers to components used in absorbent material other than the superabsorbent polymer. The size of the first absorbent material (2) was 310 mm × 150 mm, which had a basis weight of 350 g/m<sup>2</sup>.

[0204]

#### (Second Absorbent Material (2))

The second absorbent material (2) was configured with a pulp etc. to superabsorbent polymer ratio of 30:70. "Pulp etc." refers to components used in absorbent material other than the superabsorbent polymer. The size of the second absorbent material (2) was 310 mm × 150 mm, which had a basis weight of 350 g/m<sup>2</sup>.

[0205]

(Example 3)

An absorbent article was made comprising an absorbent material, a card embossed nonwoven fabric (Rengo Nonwoven Products, basis weight 23 g/m<sup>2</sup>) top sheet disposed so as to cover the top surface of the absorbent material, and a back sheet made of a liquid impermeable material disposed on the back surface of the absorbent material.

[0206]

The absorbent material in the absorbent article of the present example has the first absorbent material (2) and the second absorbent material (2) described above, and the first absorbent material (2) has hole portions penetrating from the top surface to the back surface. The bulky nonwoven fabric (air-porous nonwoven fabric) of diffusion sheet a used in the selection of diffusion sheets described above was disposed between the first absorbent material (2) and the second absorbent material (2) to cover the region including the openings in the hole portions of the first absorbent material (2). The size of the openings in the hole portions formed in the first absorbent material (2) was 20 mm × 60 mm. The diffusion sheet was disposed so that it covered the entire back surface of the first absorbent material (2). The same sheets used in Example 1 were used for the top sheet and the back sheet. The diffusion sheet disposed on the back surface of the first absorbent material (2) is referred to below as the first diffusion sheet. The composition of the absorbent article in Example 3 is shown in Table 3.

[0207]

[Table 3]

|                                             |                         | Ex. 3             | Ex. 4             | Ex. 5             | Ex. 6             | Ex. 7             | Ex. 8             | Ex. 9                   |
|---------------------------------------------|-------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------------|
| Hole portion in absorbent material (Yes/No) | 1st absorbent material  | Yes               | Yes               | Yes               | Yes               | Yes               | Yes               | Yes                     |
|                                             | 2nd absorbent material  | No                | Yes               | Yes               | Yes               | Yes               | Yes               | Yes (Position mismatch) |
| Diffusion sheet                             | 1st diffusion sheet (2) | Diffusion sheet a | Diffusion sheet a | Diffusion sheet a | No                | Diffusion sheet b | Diffusion sheet a | Diffusion sheet a       |
|                                             | 2nd diffusion sheet (2) | No                | No                | Diffusion sheet a | Diffusion sheet a | Diffusion sheet a | Diffusion sheet b | Diffusion sheet a       |
| Amount of saline (ml)                       |                         | 100               | 100               | 100               | 100               | 100               | 100               | 100                     |
| Absorbency time (sec)                       |                         | 81                | 77                | 63                | 82                | 20                | 19                | 81                      |

[0208]

(Example 4)

An absorbent article (Example 4) was made in the same manner as the absorbent article in Example 3 except that the second absorbent material (2) has a second hole portion that penetrates from the top surface to the back surface of the second absorbent material. The second hole portion formed in the second absorbent material (2) is in the same position and has the same shape as the hole portion in the first absorbent material (2).

[0209]

(Example 5)

An absorbent article (Example 5) was made in the same manner as the absorbent article in Example 4 except that a diffusion sheet (second diffusion sheet) is disposed on the back

surface of the second absorbent material (2) to cover the region including the opening in the second hole portion of the second absorbent material (2). The second diffusion sheet disposed on the back surface of the second absorbent materials (2) was the bulky nonwoven fabric (air-permeable nonwoven fabric) of diffusion sheet a used in the selection of diffusion sheets described above.

[0210]

(Example 6)

An absorbent article (Example 6) was made in the same manner as the absorbent article in Example 5 except that just a second diffusion sheet is disposed on the back surface of the second absorbent material as a diffusion sheet. A first diffusion sheet is not used.

[0211]

(Example 7)

An absorbent article (Example 7) was made in the same manner as the absorbent article in Example 5 except that the first diffusion sheet is the porous film of diffusion sheet b used in the selection of diffusion sheets described above.

[0212]

(Example 8)

An absorbent article (Example 8) was made in the same manner as the absorbent article in Example 5 except that the second diffusion sheet is the porous film of diffusion sheet b used in the selection of diffusion sheets described above.

[0213]

(Example 9)

An absorbent article (Example 9) was made in the same manner as the absorbent article in Example 5 except that the second hole portion in the second absorbent material is formed in a different position from the hole portion in the first absorbent material.

[0214]

(Comparative Examples 4-8)

Absorbent articles (Comparative Examples 4-8) were made in the same manner as the absorbent article in Example 3 except that the hole portions in the first absorbent material and the second absorbent material, and the diffusion sheet disposed on the back surface of each absorbent material are shown in Table 4. In the absorbent articles in Comparative Examples 7 and 8, the bulky nonwoven fabric (air-permeable nonwoven fabric) of diffusion sheet a used in the selection of diffusion sheets described above was disposed on the top surface of the first absorbent material as the top surface-side diffusion sheet.

[0215]

[Table 4]

|                                             |                             | C. Ex. 4 | C. Ex. 5 | C. Ex. 6 | C. Ex. 7          | C. Ex. 8          |
|---------------------------------------------|-----------------------------|----------|----------|----------|-------------------|-------------------|
| Hole portion in absorbent material (Yes/No) | 1st absorbent material      | No       | Yes      | Yes      | No                | Yes               |
|                                             | 2nd absorbent material      | No       | No       | Yes      | No                | No                |
| Diffusion sheet                             | Top surface diffusion sheet | No       | No       | No       | Diffusion sheet a | Diffusion sheet a |
|                                             | 1st diffusion sheet (2)     | No       | No       | No       | No                | No                |
|                                             | 2nd diffusion sheet (2)     | No       | No       | No       | No                | No                |
| Amount of saline (ml)                       |                             | 100      | 100      | 100      | 100               | 100               |
| Absorbency time (sec)                       |                             | 402      | 125      | 112      | 197               | 86                |

[0216]

(Example 10)

An absorbent article (Example 10) was made with the same configuration as the absorbent article in Example 3, except that the first diffusion sheet was a 200 mm × 150 mm rectangle, as shown in Table 5. The diffusion sheet was also disposed to cover the region including the opening in the hole portion of the first absorbent material.

[0217]

[Table 5]

|                                             |                             | Ex. 3                      |     |     | Ex. 10            | Ex. 11            | C. Ex. 9                   |
|---------------------------------------------|-----------------------------|----------------------------|-----|-----|-------------------|-------------------|----------------------------|
| Size of diffusion sheet                     |                             | Same as absorbent material |     |     | 200 mm x 150 mm   | 200 mm x 100 mm   | Same as absorbent material |
| Hole portion in absorbent material (Yes/No) | 1st absorbent material      | Yes                        |     |     | Yes               | Yes               | Yes                        |
|                                             | 2nd absorbent material      | No                         |     |     | No                | No                | No                         |
| Diffusion sheet                             | Top surface diffusion sheet | No                         |     |     | No                | No                | Diffusion sheet a          |
|                                             | 1st diffusion sheet (2)     | Diffusion sheet a          |     |     | Diffusion sheet a | Diffusion sheet a | No                         |
|                                             | 2nd diffusion sheet (2)     | No                         |     |     | No                | No                | No                         |
| Amount of saline (ml)                       |                             | 100                        | 200 | 300 | 300               | 300               | 300                        |
| Absorbency time (sec)                       |                             | 81                         | 165 | 236 | 232               | 244               | 254                        |

[0218]

(Example 11)

An absorbent article (Example 11) was made with the same configuration as the absorbent article in Example 1, except that the first diffusion sheet was a 200 mm × 100 mm rectangle. The diffusion sheet was also disposed to cover the region including the opening in the hole portion of the first absorbent material.

[0219]

(Comparative Example 9)

An absorbent article (Comparative Example 9) was made with the same configuration as the absorbent article in Comparative Example 8.

[0220]

(4) Considerations:

The absorbent articles of the present invention in Examples 1 to 9 had shorter absorption times for saline solution simulating excretory fluid than the absorbent articles in the

comparative examples. As shown in Table 2, Comparative Example 3 using a diffusion sheet (tissue) with lower liquid permeability than the absorbent material, had the same configuration as Examples 1 and 2, which had a diffusion sheet disposed on the back surface of the first absorbent material. However, the result was an increase in absorption time.

[0221]

As shown in Table 3, Examples 7 and 8, which used a porous film as the diffusion sheet, had significantly shorter absorption times than the other examples and were extremely absorbent. The first diffusion sheet (2) and the second diffusion sheet (2) may be made of the same material as in the case of Example 9 in Table 3, or they may be made of different materials as in the case of Examples 7 and 8.

[0222]

As shown in Table 5, in the liquid absorption test in which a large amount of saline solution (200 ml or 300 ml) was absorbed, the absorption times of the examples were shorter than that of the absorbent material in Comparative Example 9, confirming their superior absorbency.

[Industrial Applicability]

[0223]

Absorbent articles of the present invention can be used as tape-style or pants-style disposable diapers for infants or for adults such as the elderly or disabled, as urine pads placed inside clothing to absorb excretory fluid, sanitary napkins to absorb menstrual blood, and vaginal discharge sheets that absorb vaginal discharge.

[Brief Description of the Drawings]

[0224]

[Fig. 1]

Fig. 1 is a partially cutaway plan view of the first embodiment of the first absorbent article of the present invention showing the absorbent article from the top sheet side.

[Fig. 2]

Fig. 2 is a cross-sectional view of the first absorbent article in Fig. 1 from line A-A'.

[Fig. 3]

Fig. 3 is a cross-sectional view of the first absorbent article in Fig. 1 from line B-B'.

[Fig. 4]

Fig. 4 is a partially cutaway plan view of another embodiment of the first absorbent article of the present invention showing the absorbent article from the top sheet side.

[Fig. 5]

Fig. 5 is a cross-sectional view of the first absorbent article in Fig. 4 from line C-C'.

[Fig. 6]

Fig. 6 is a partially cutaway plan view of yet another embodiment of the first absorbent article of the present invention showing the absorbent article from the top sheet side.

[Fig. 7]

Fig. 7 is a cross-sectional view of the first absorbent article in Fig. 6 from line D-D'.

[Fig. 8A]

Fig. 8A is a partially cutaway plan view of yet another embodiment of the first absorbent article of the present invention showing the absorbent article from the top sheet side.

[Fig. 8B]

Fig. 8B is a partially cutaway plan view of yet another embodiment of the first absorbent article of the present invention showing the absorbent article from the top sheet side.

[Fig. 9A]

Fig. 9A is a partially cutaway plan view of yet another embodiment of the first absorbent article of the present invention showing the absorbent article from the top sheet side.

[Fig. 9B]

Fig. 9B is a partially cutaway plan view of yet another embodiment of the first absorbent article of the present invention showing the absorbent article from the top sheet side.

[Fig. 10A]

Fig. 10A is a cross-sectional view showing another embodiment of the first absorbent article of the present invention.

[Fig. 10B]

Fig. 10B is a cross-sectional view showing another embodiment of the first absorbent article of the present invention.

[Fig. 11]

Fig. 11 is a partially cutaway plan view of the first embodiment of the second absorbent article of the present invention showing the absorbent article from the top sheet side.

[Fig. 12]

Fig. 12 is a cross-sectional view of the second absorbent article in Fig. 11 from line E-E'.

[Fig. 13]

Fig. 13 is a cross-sectional view showing another embodiment of the second absorbent article of the present invention.

[Fig. 14A]

Fig. 14A is a cross-sectional view showing another embodiment of the second absorbent article of the present invention.

[Fig. 14B]

Fig. 14B is a cross-sectional view showing another embodiment of the second absorbent article of the present invention.

[Fig. 15]

Fig. 15 is a cross-sectional view showing another embodiment of the second absorbent article of the present invention.

[Fig. 16A]

Fig. 16A is a cross-sectional view showing another embodiment of the second absorbent article of the present invention.

[Fig. 16B]

Fig. 16B is a cross-sectional view showing another embodiment of the second absorbent article of the present invention.

[Fig. 17]

Fig. 17 is a cross-sectional view showing another embodiment of the second absorbent article of the present invention.

[Fig. 18]

Fig. 18 is a cross-sectional view showing another embodiment of the second absorbent article of the present invention.

[Fig. 19]

Fig. 19 is a partially cutaway plan view of the first embodiment of the third absorbent article of the present invention showing the absorbent article from the top sheet side.

[Fig. 20]

Fig. 20 is a cross-sectional view of the third absorbent article in Fig. 19 from line F-F'.

[Fig. 21]

Fig. 21 is a cross-sectional view showing another embodiment of the third absorbent article of the present invention.

[Fig. 22]

Fig. 22 is a cross-sectional view showing another embodiment of the first absorbent article of the present invention.

[Fig. 23]

Fig. 23 is a cross-sectional view showing another embodiment of the second absorbent article of the present invention.

[Fig. 24]

Fig. 24 is a cross-sectional view showing another embodiment of the second absorbent article of the present invention.

[Fig. 25]

Fig. 25 is a cross-sectional view showing another embodiment of the second absorbent article of the present invention.

[Fig. 26]

Fig. 26 is a partially cutaway plan view of the tape-style diaper in yet another embodiment of an absorbent article of the present invention showing the absorbent article from the top sheet side with the tape-style diaper open.

[Fig. 27]

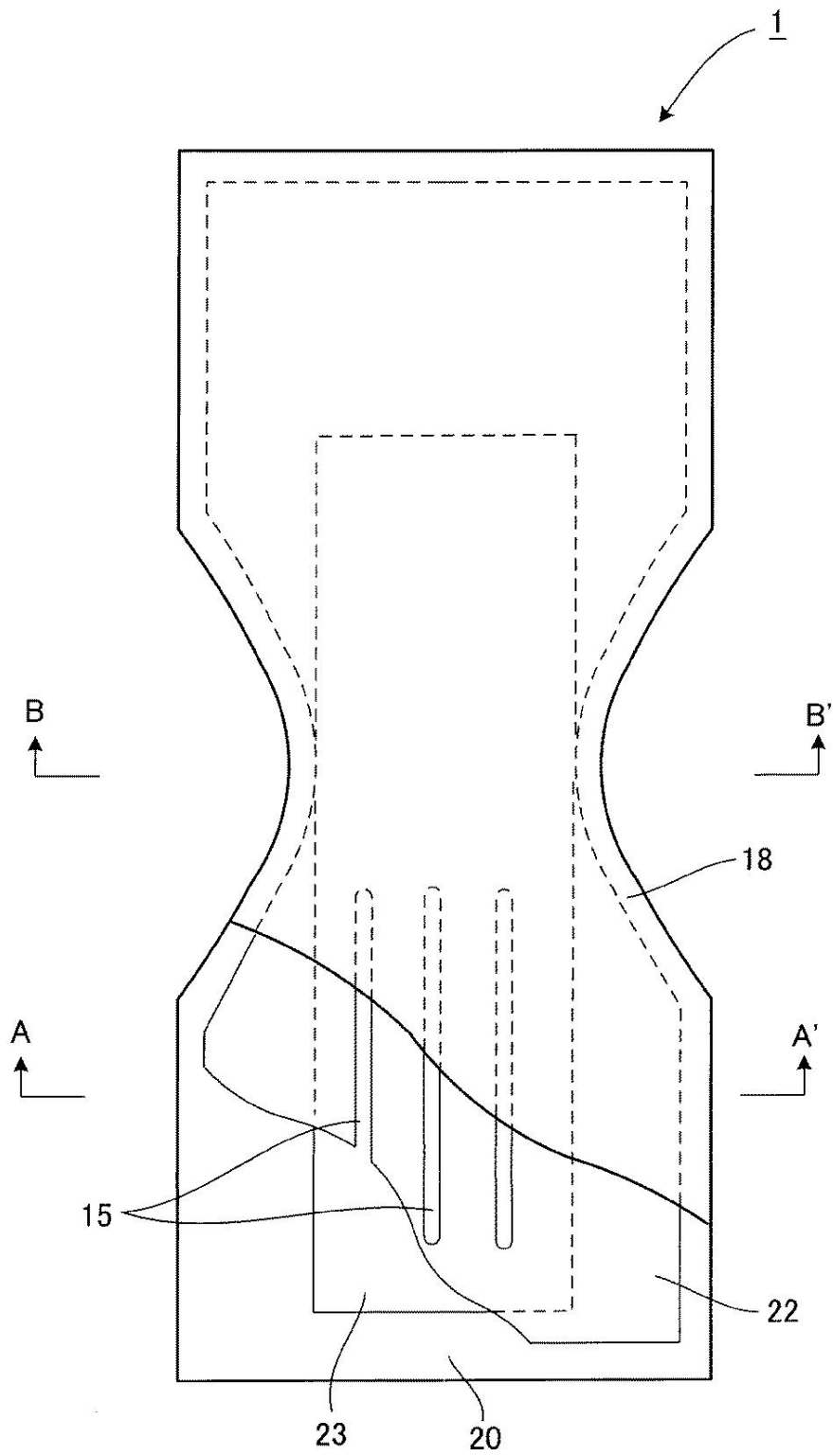
Fig. 27 is a partially cutaway plan view of the pants-style diaper in yet another embodiment of an absorbent article of the present invention showing the pants-style diaper from above.

[Explanation of Reference Numbers]

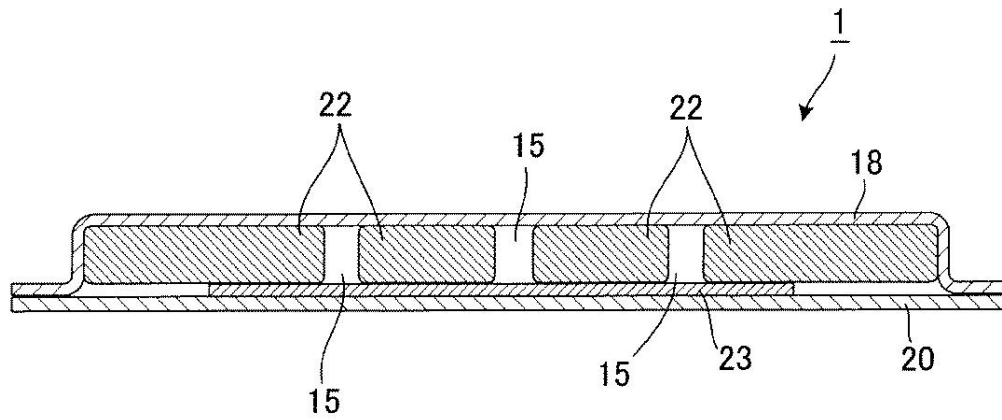
[0225]

1: Absorbent article (first absorbent article), 2: front piece, 2a, 2b: side edge portion, 4: crotch portion, 5: side flap, 6: rear piece, 6a, 6b: side edge portion, 7: fastening tape, 8: joined portion, 10: waist opening, 11: front patch, 12, 12a, 12b: leg opening, 14: absorbent material, 15: hole portion, 18: top sheet, 18a: center sheet, 18b: side sheet, 20: back sheet, 22: absorbent material, 23: diffusion sheet, 26, 26a, 26b: three-dimensional gather, 36, 36a, 36b: three-dimensional gather elastic member, 40: leg surrounding elastic band, 42: waist surrounding elastic band, 46: rising line, 51: hydrophilic sheet, 61: absorbent article (second absorbent article), 62: absorbent material, 62a: first absorbent material, 62b: second absorbent material, 63: diffusion sheet, 65: hole portion, 66: hole portion (second hole portion), 71: absorbent article (third absorbent article), 72: absorbent material, 72a: first absorbent material, 72b: second absorbent material, 73: diffusion sheet (first diffusion sheet), 74: diffusion sheet (second diffusion sheet), 75: hole portion, 76: hole portion (second hole portion), 100: tape-style diaper, 110: pants-style diaper

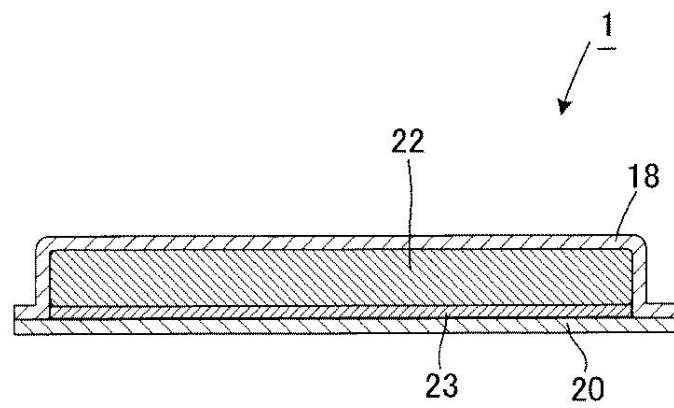
[Fig. 1]



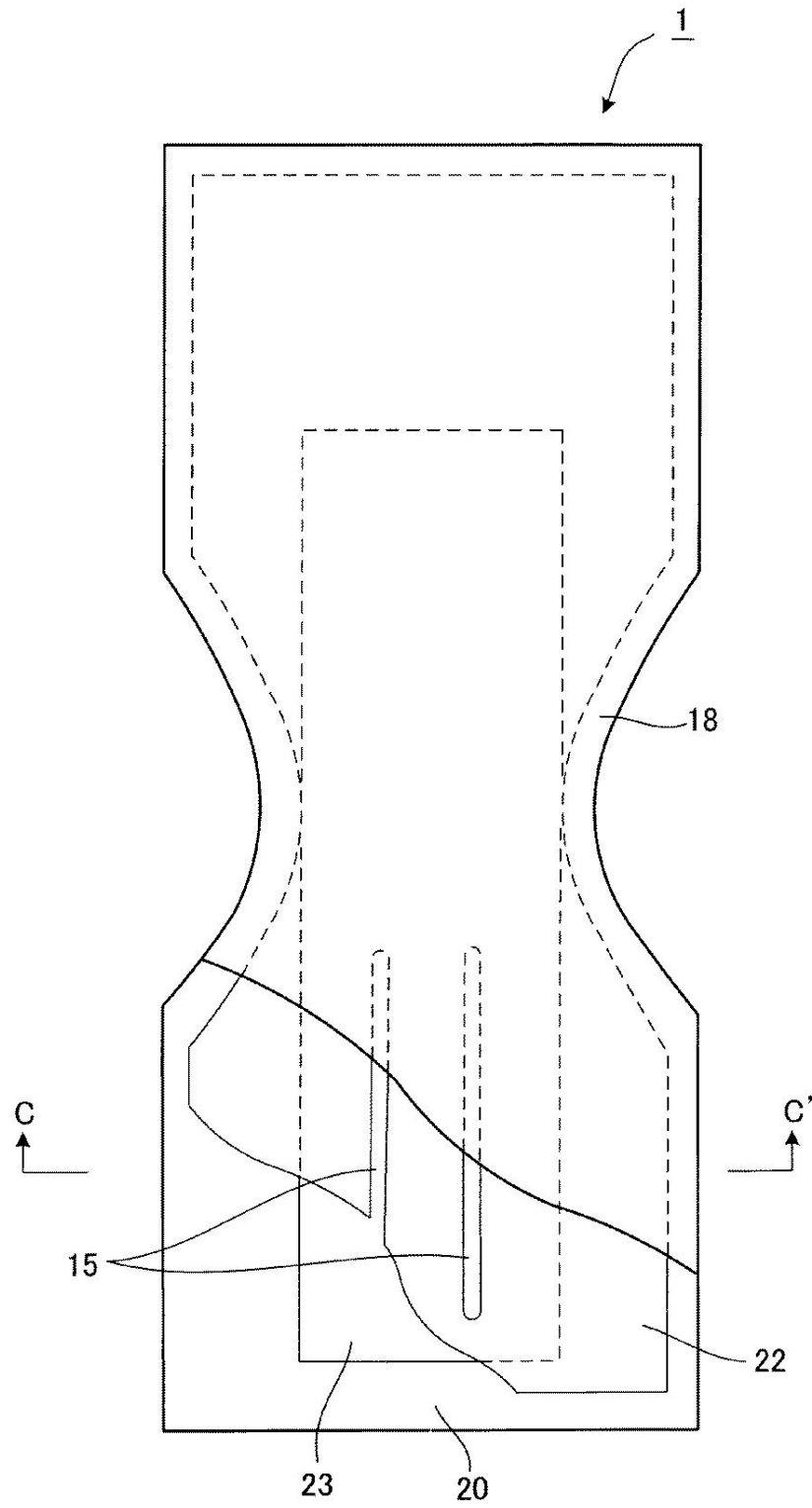
[Fig. 2]



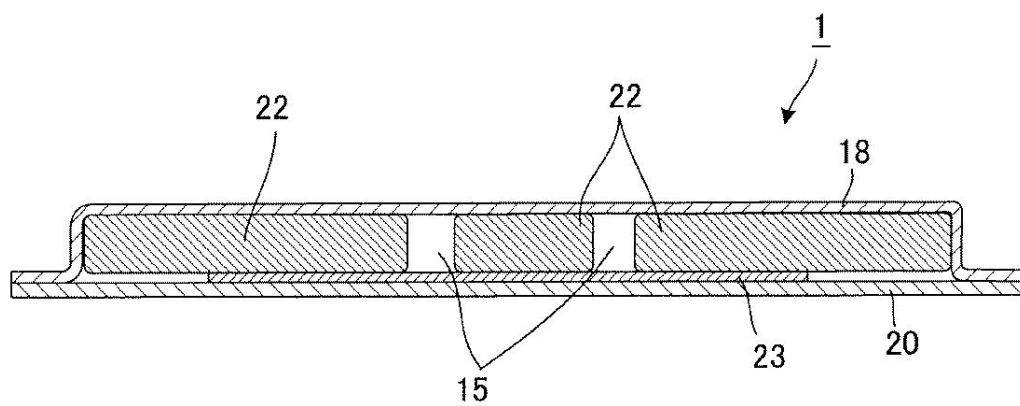
[Fig. 3]



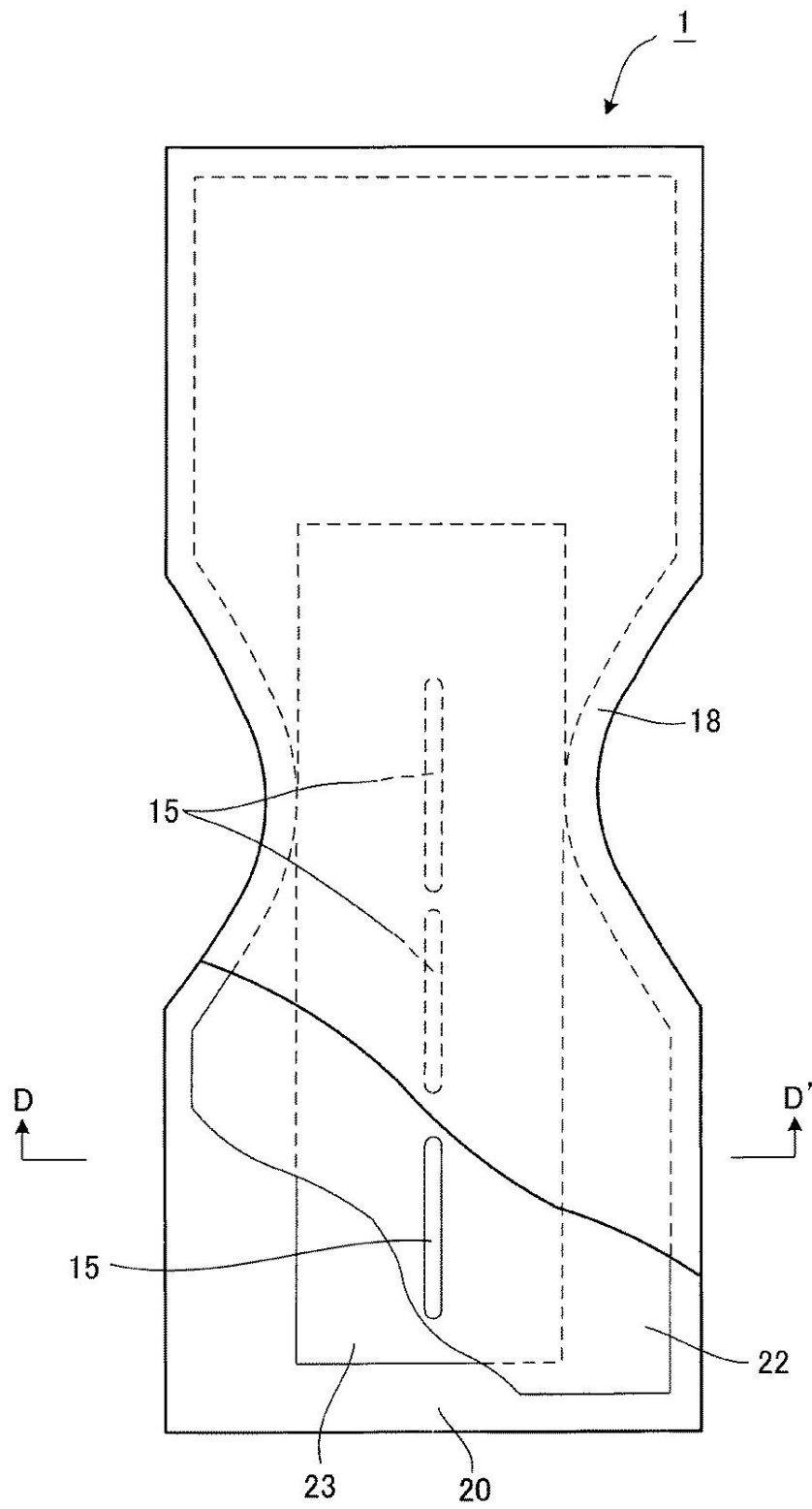
[Fig. 4]



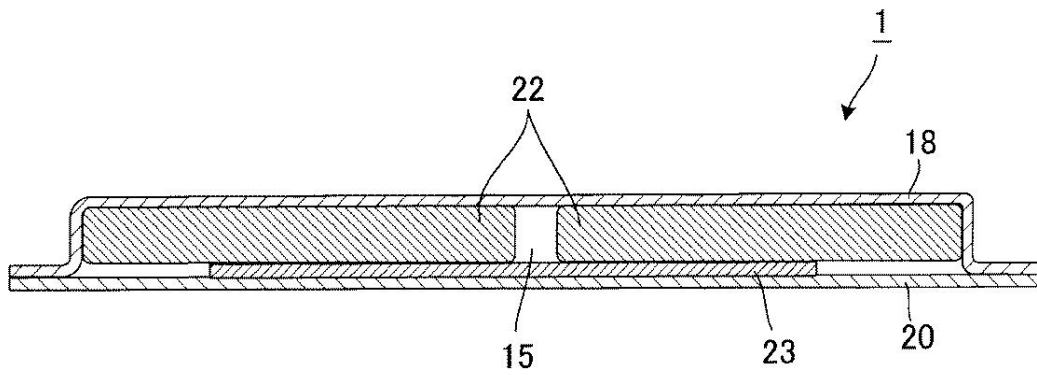
[Fig. 5]



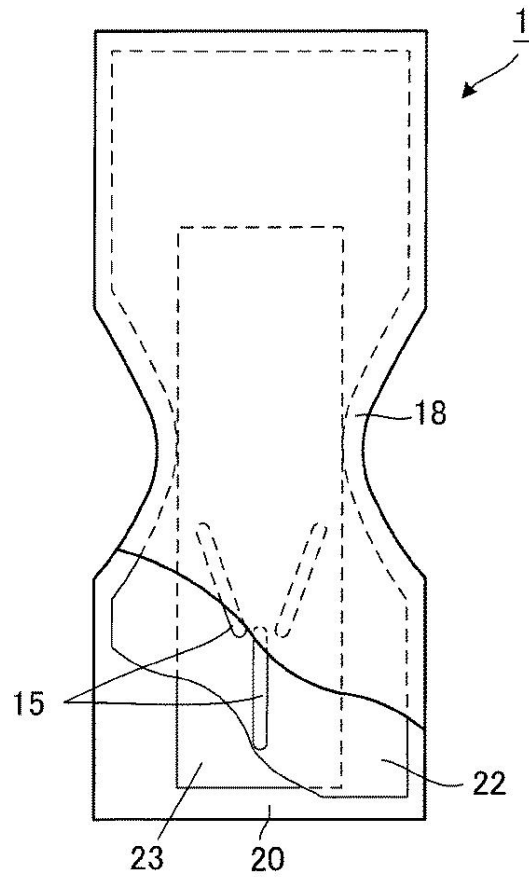
[Fig. 6]



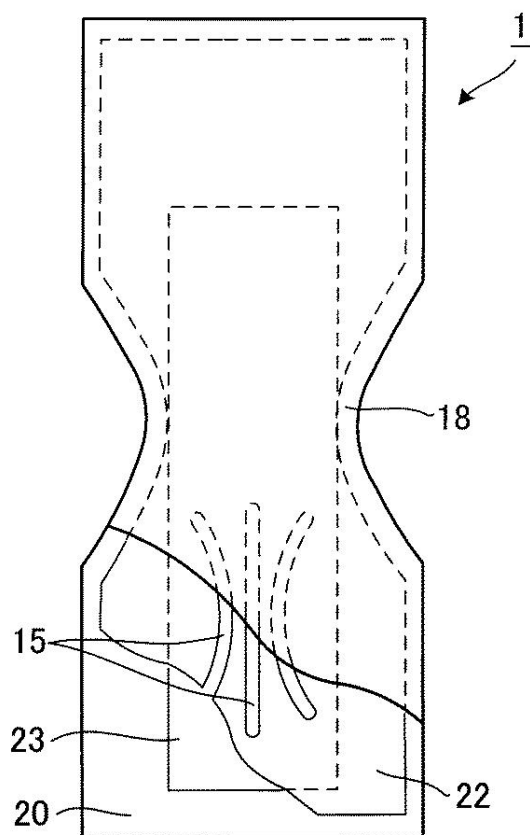
[Fig. 7]



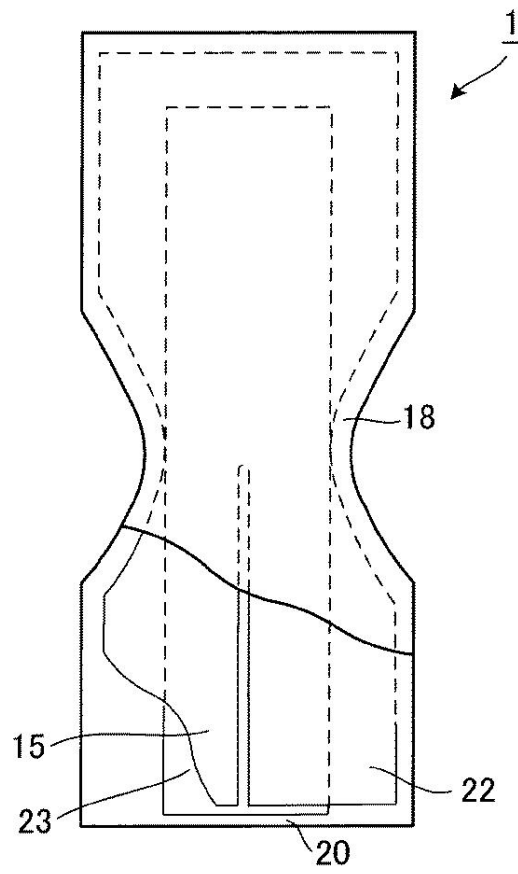
[Fig. 8A]



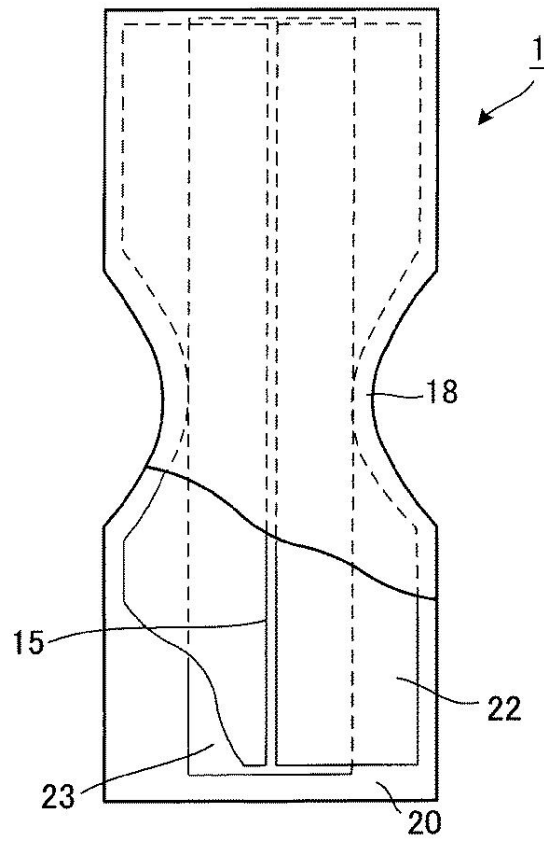
[Fig. 8B]



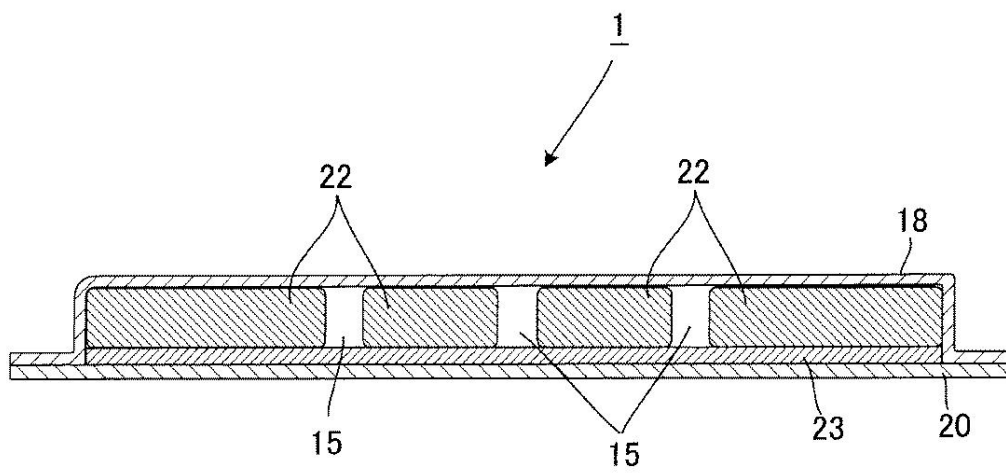
[Fig. 9A]



[Fig. 9B]

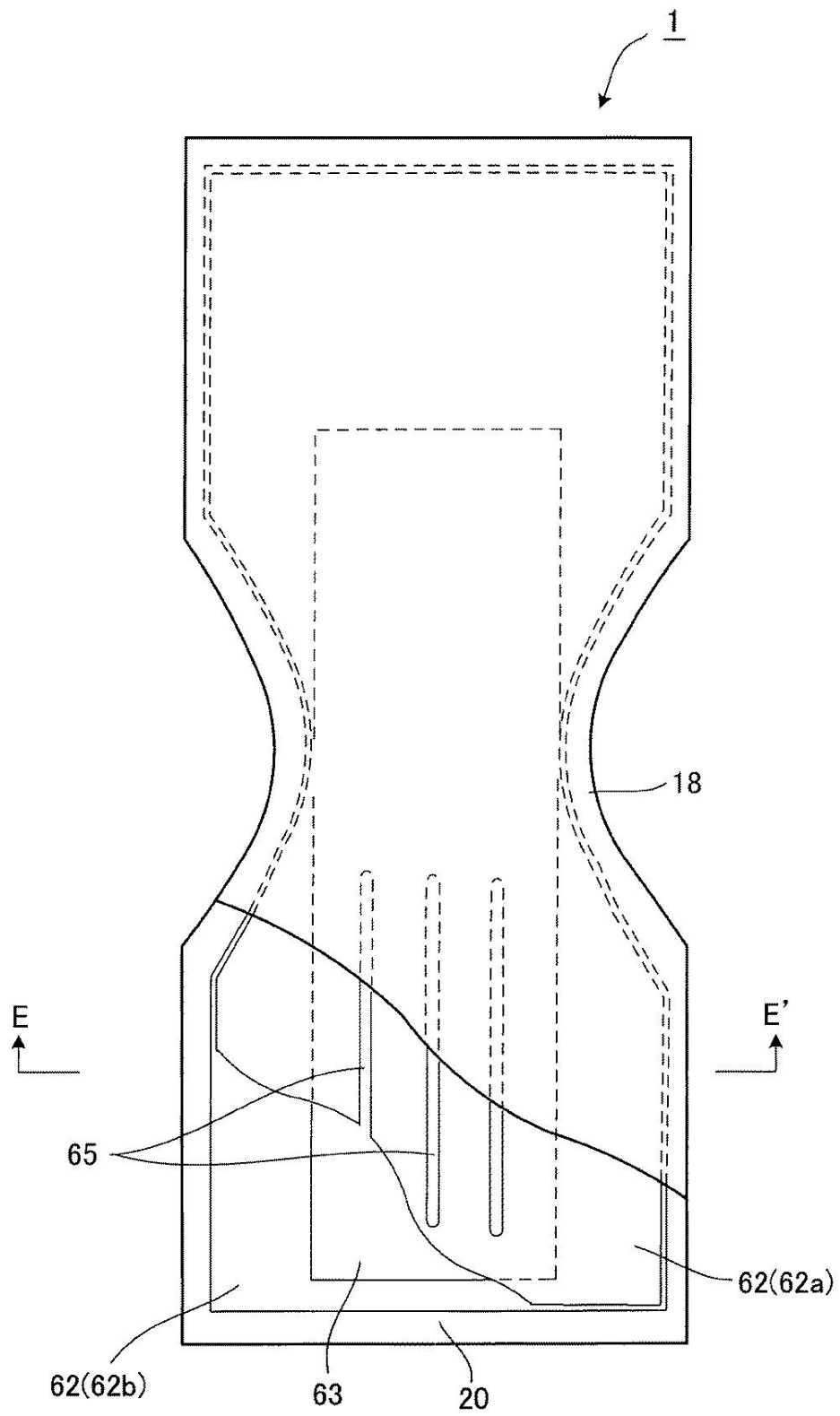


[Fig. 10A]

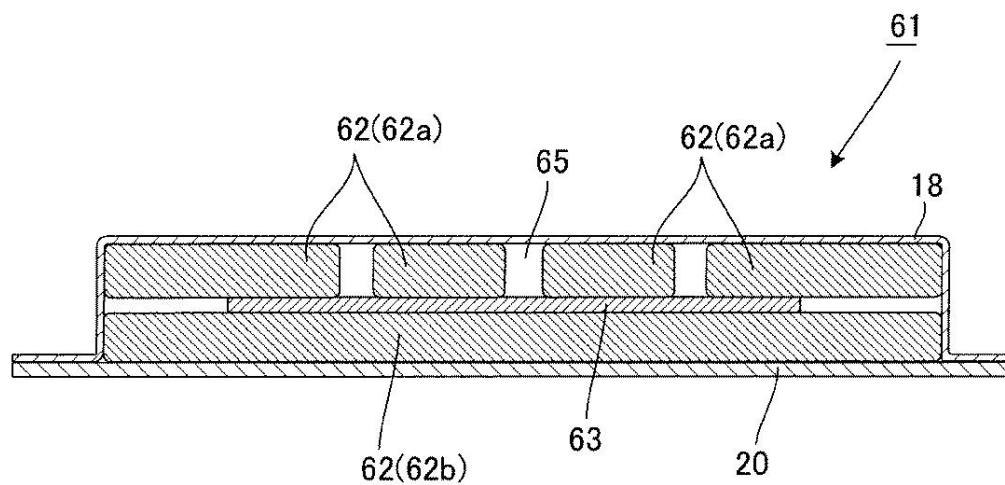


A cross-sectional view of a device 1. It consists of a top layer 18, a middle layer 20, and a bottom layer 23. The middle layer 20 contains two rectangular blocks 15. The top layer 18 has two rectangular blocks 22 positioned above the blocks 15. The device 1 is shown with a cross-section that is wider at the ends and narrower in the middle.

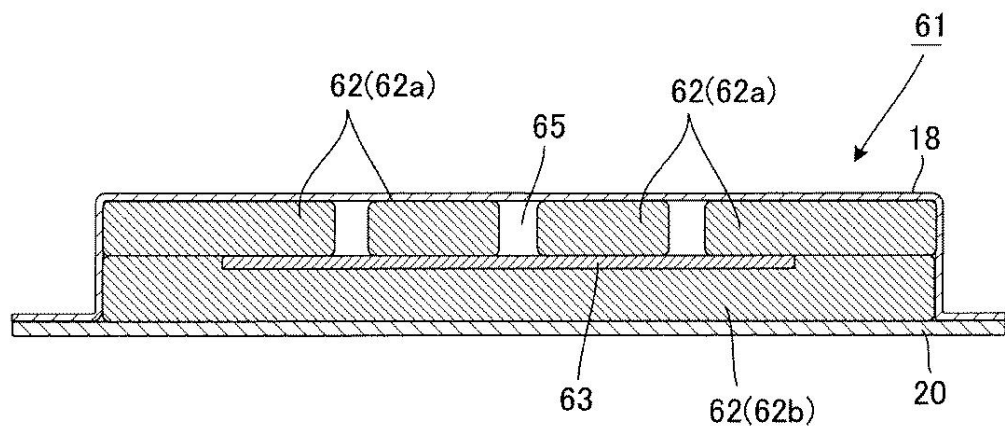
[Fig. 11]



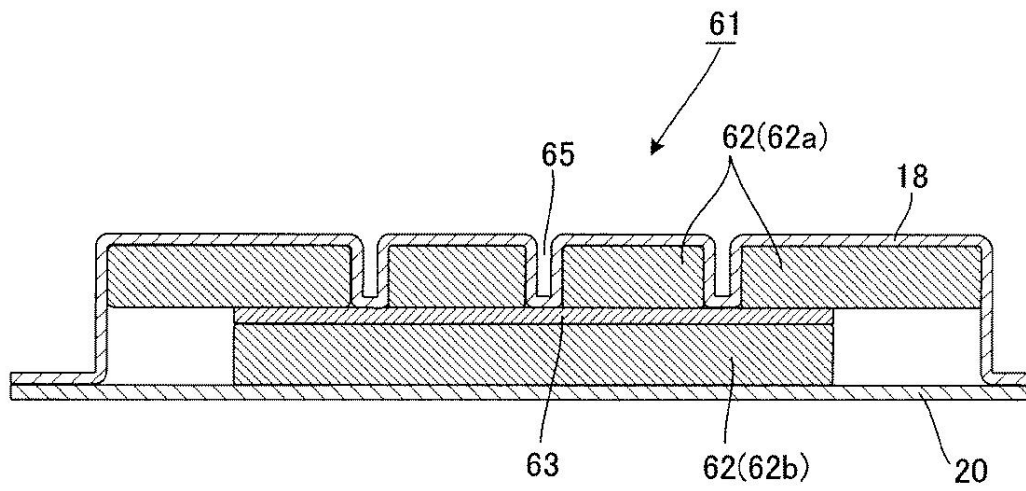
[Fig. 12]



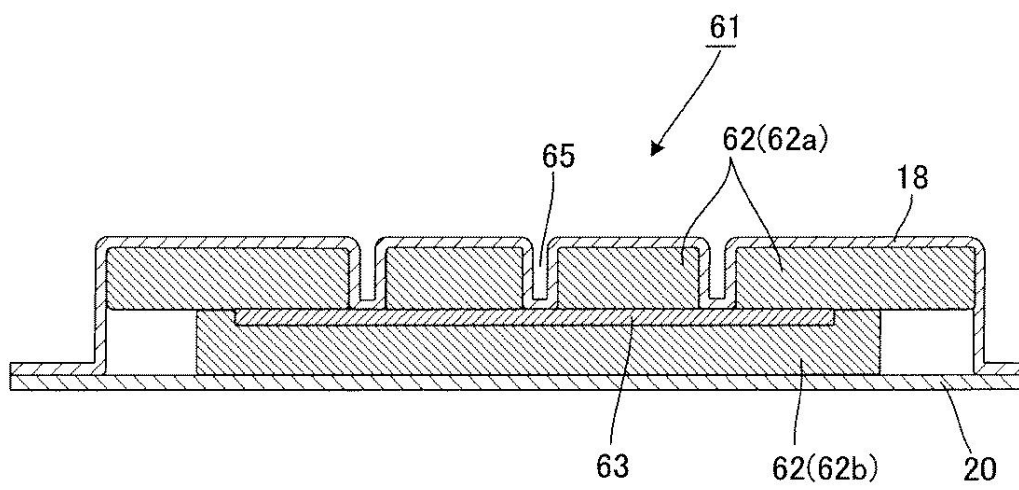
[Fig. 13]



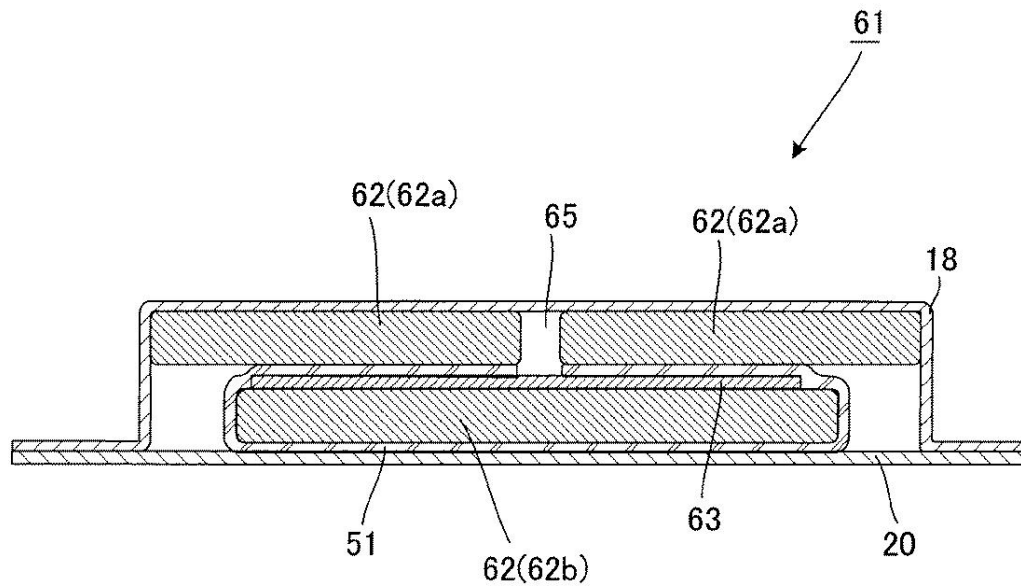
[Fig. 14A]



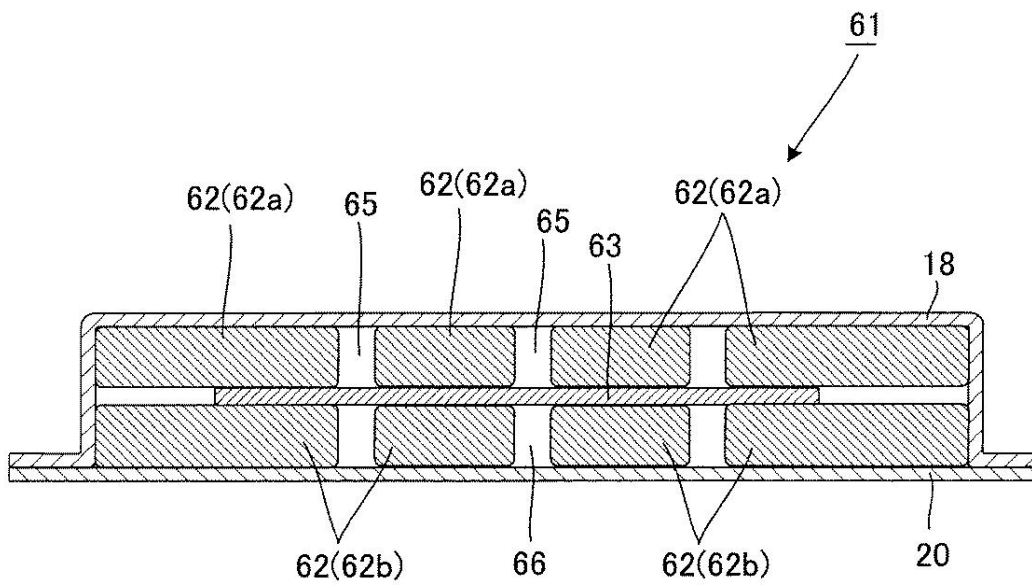
[Fig. 14B]



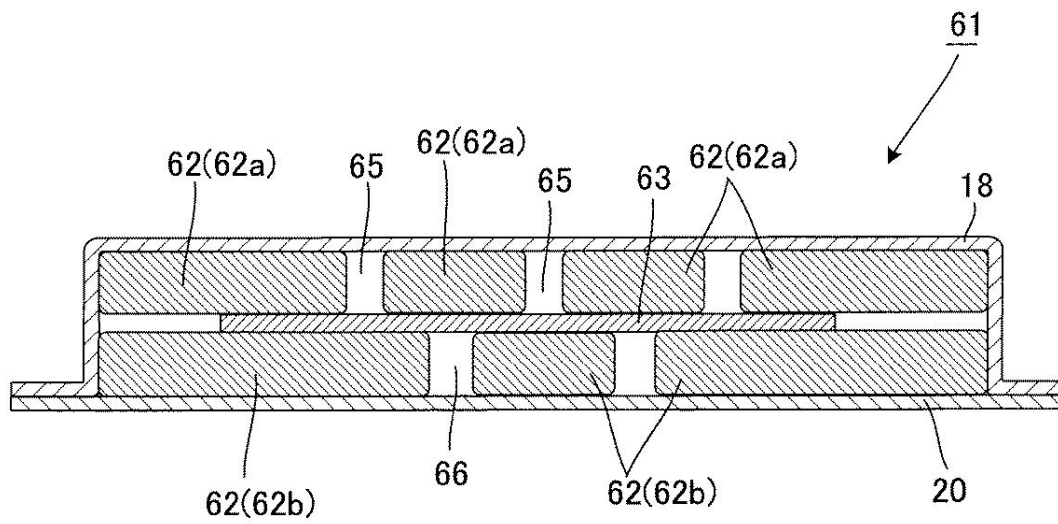
[Fig. 15]



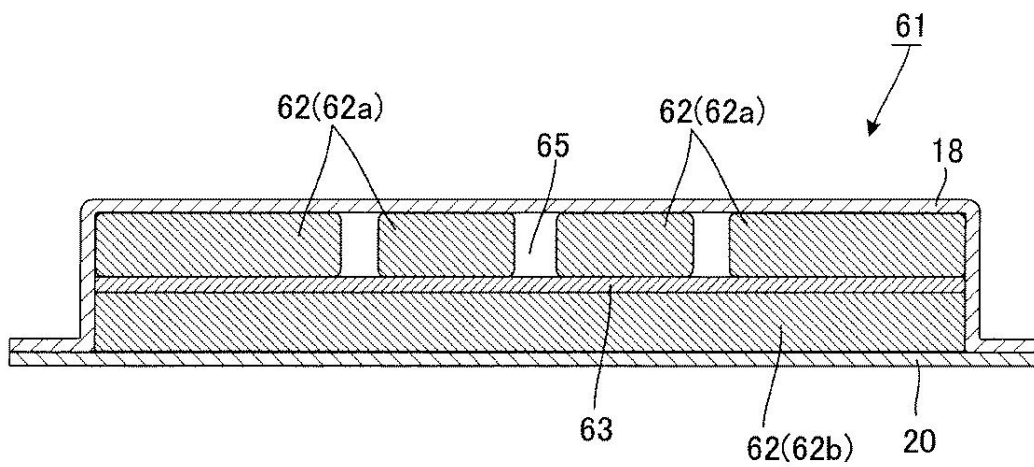
[Fig. 16A]



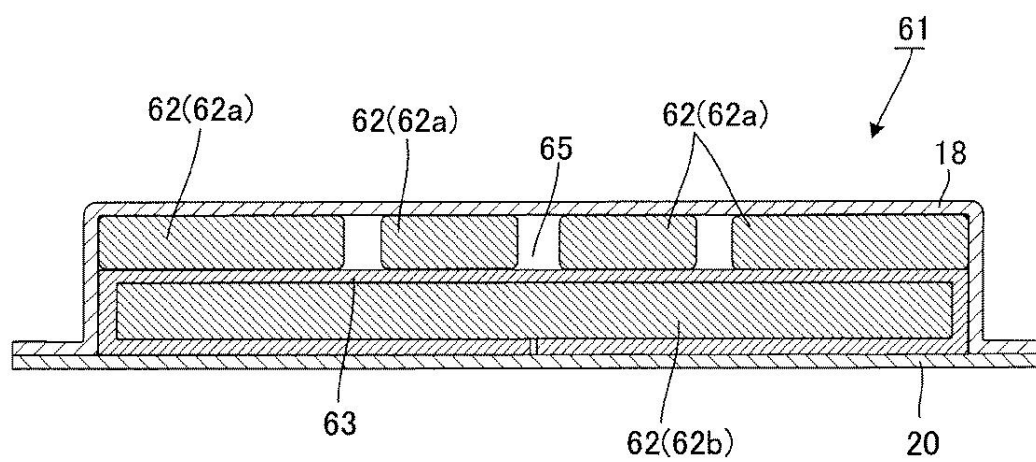
[Fig. 16B]



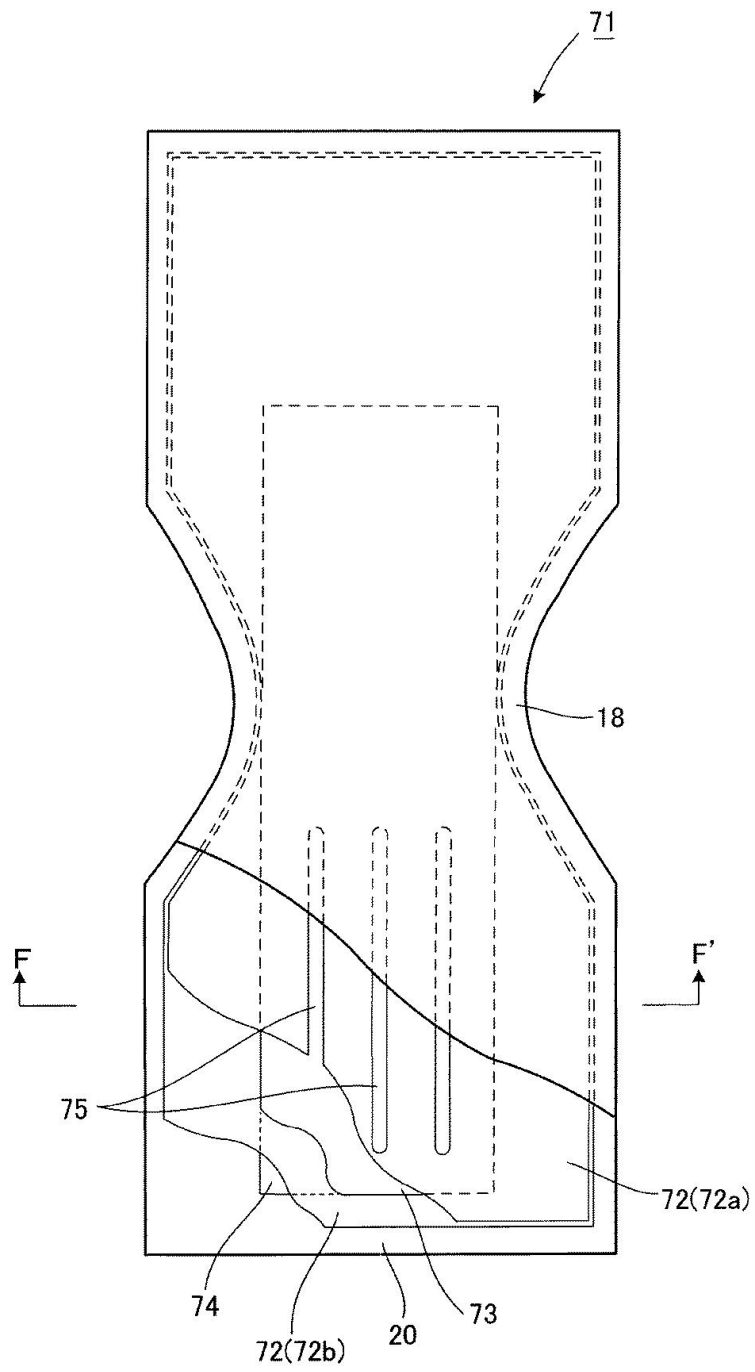
[Fig. 17]



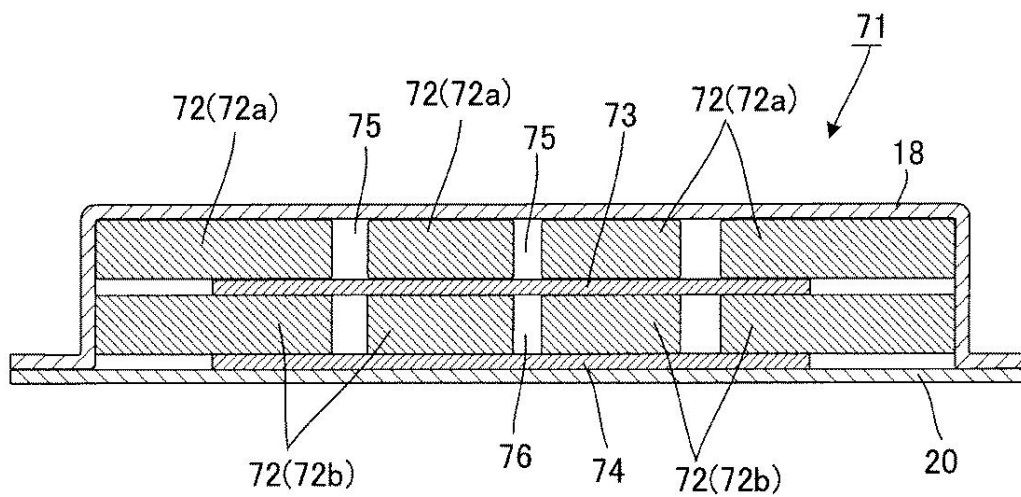
[Fig. 18]



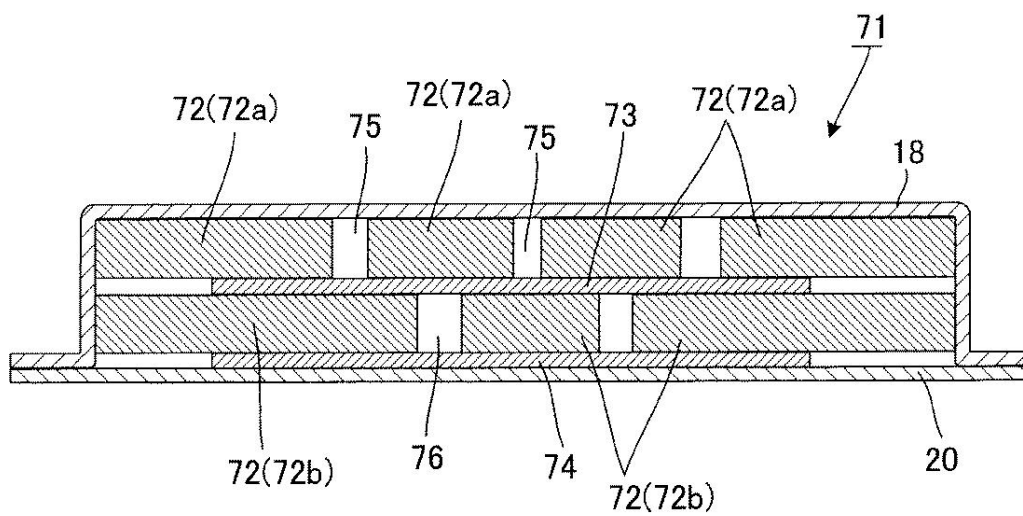
[Fig. 19]



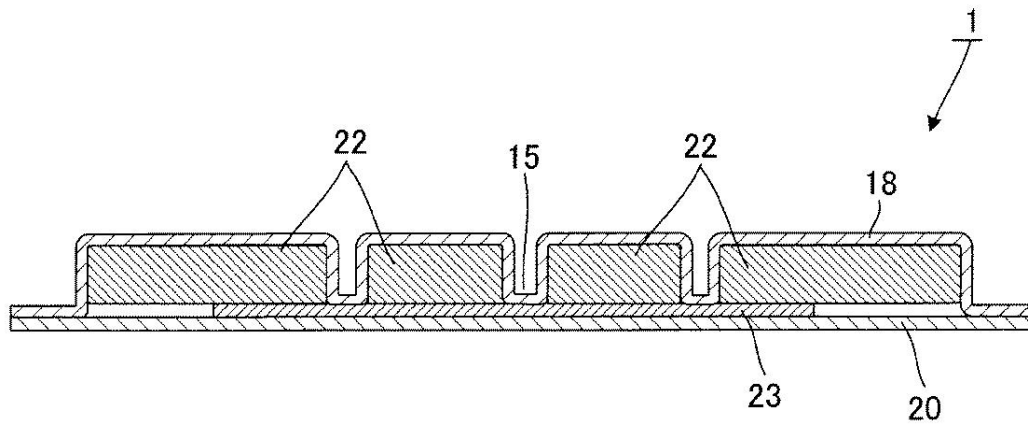
[Fig. 20]



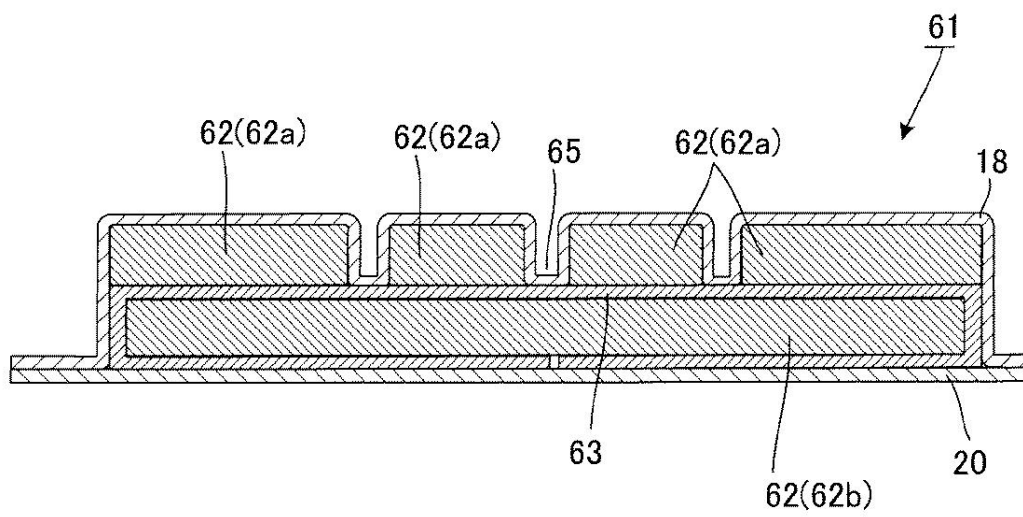
[Fig. 21]



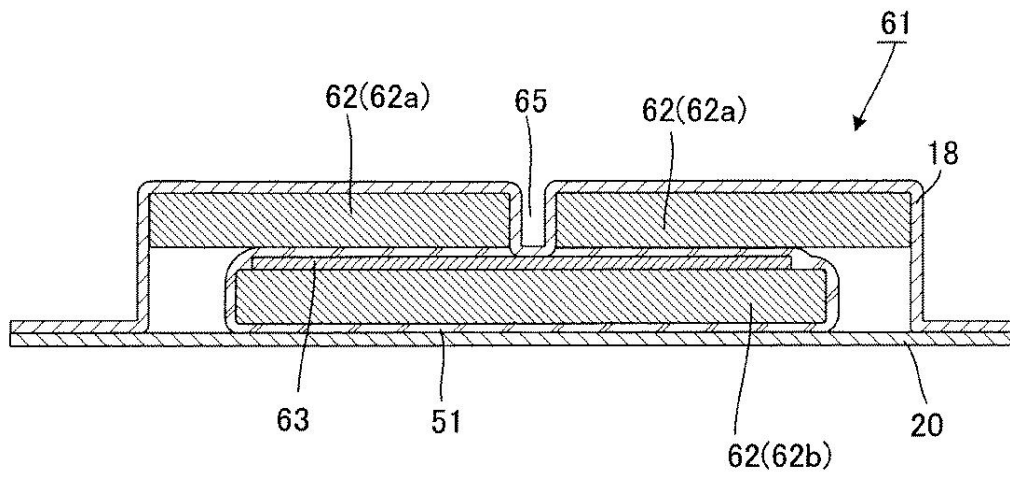
[Fig. 22]



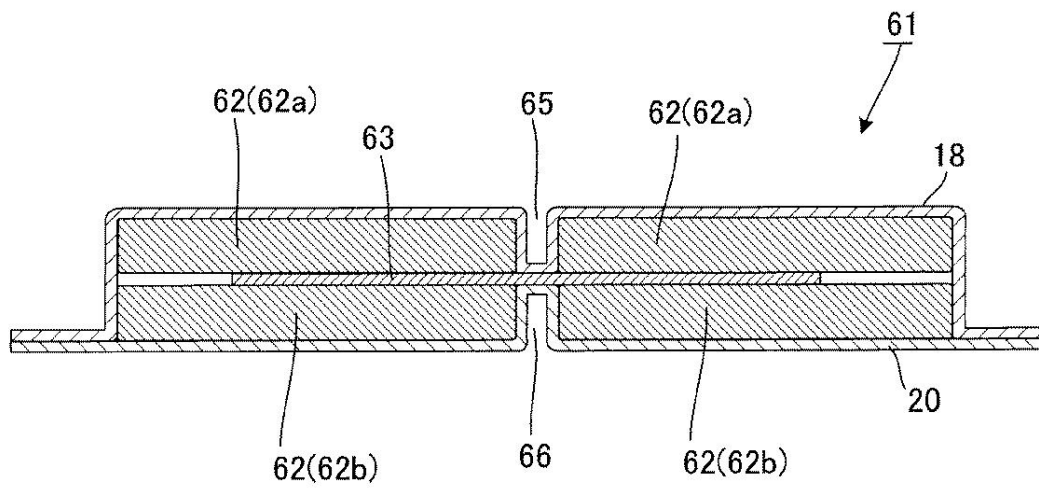
[Fig. 23]



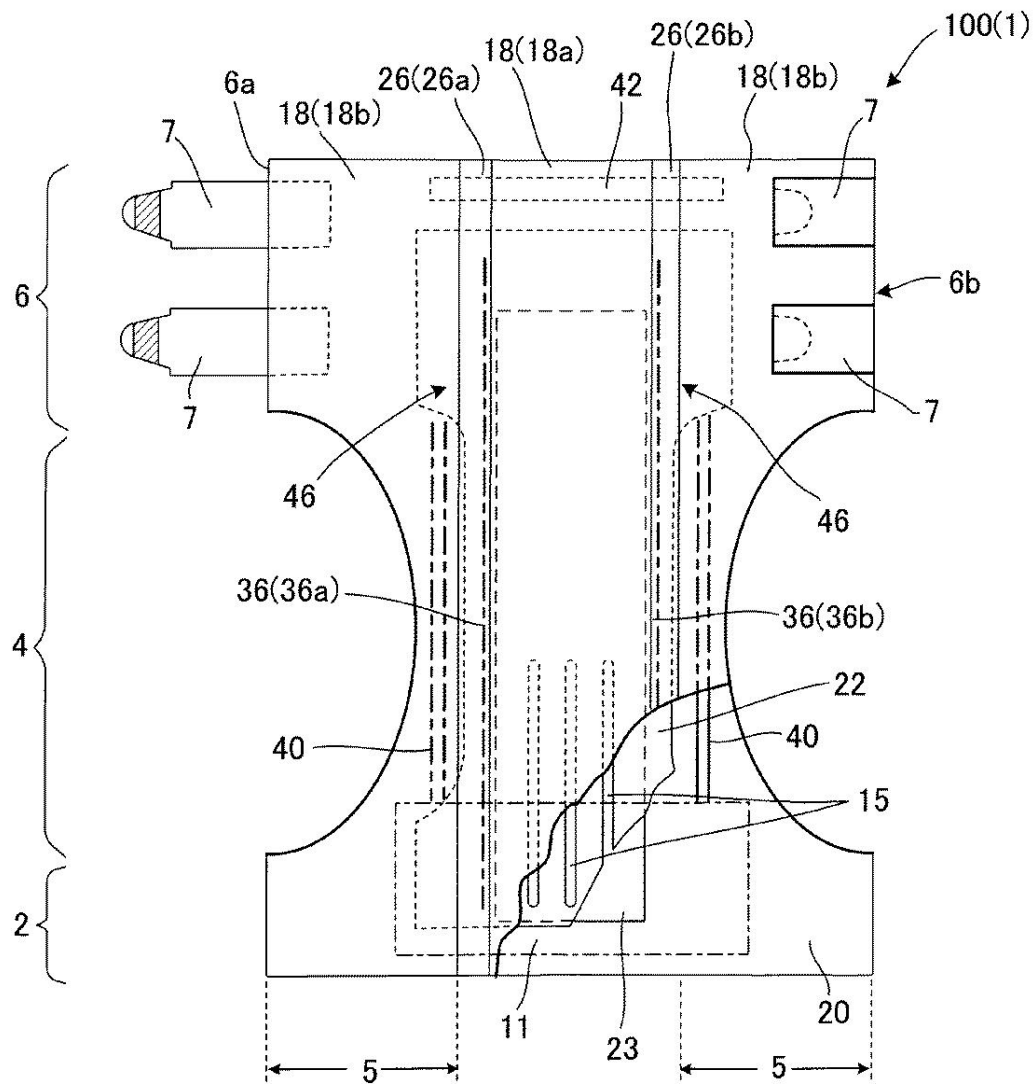
[Fig. 24]



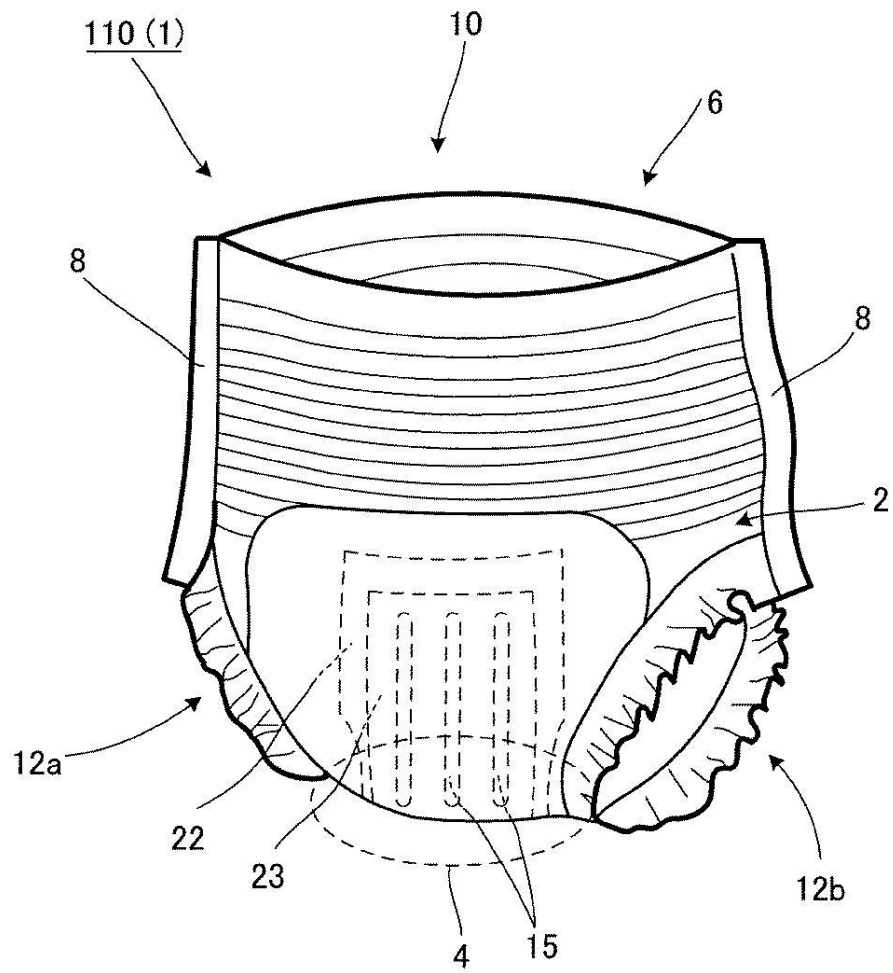
[Fig. 25]



[Fig. 26]



[Fig. 27]





**Certification of Accuracy of Translation**

**Sun IP Project # 24-4174**

I, Frank McGee, hereby declare:

That I possess advanced knowledge of the Japanese and English languages. The attached Japanese into English translation of JP2008284190A has been translated by me and to the best of my knowledge, is a true and accurate translation.

Declarant hereby acknowledges that any willful false statements made in this Declaration are punishable by fine or imprisonment, or both. Furthermore, all statements made of Declarant's own knowledge are true, and all statements made on information and belief are believed to be true.

July 29, 2024

A handwritten signature in blue ink, appearing to read "F. McGee", with a long horizontal flourish extending to the right.