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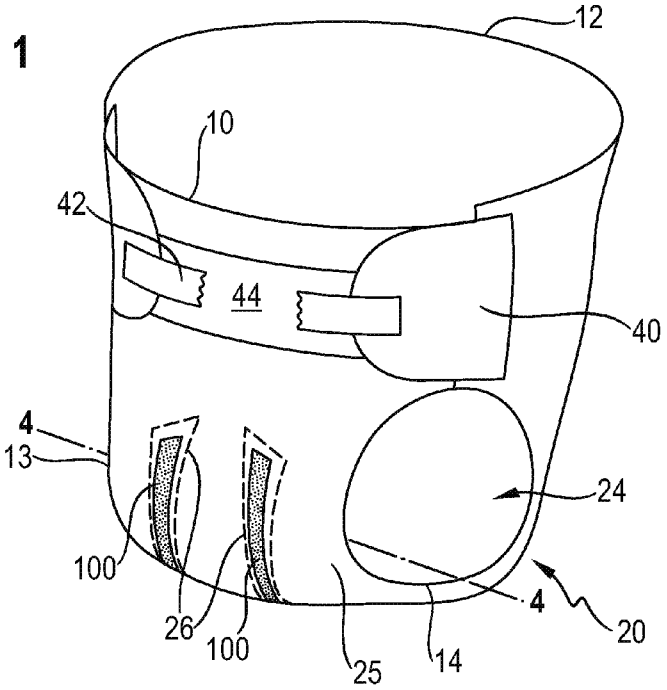
(54) Title: ABSORBENT ARTICLES HAVING CHANNELS AND WETNESS INDICATOR

Fig. 1




(57) Abstract: An absorbent article (20), such as a diaper or a training pant, having a wearer-facing side and a garment-facing side and a longitudinal axis (80). The absorbent article comprises a topsheet (24) on the wearer-facing side, a backsheet (25) on the garment-facing side, and an absorbent core (28) between the topsheet and backsheet. The absorbent core comprises a pair of generally longitudinally-extending channels. The absorbent article further comprises a wetness indicator (100) at least partially superposed with at least one of the channels, as seen from the garment-facing side of the article.

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# ABSORBENT ARTICLES HAVING CHANNELS AND WETNESS INDICATOR

## FIELD OF THE INVENTION

The invention is directed at absorbent articles for personal hygiene that are worn in the crotch region of the wearer, for example baby diapers, training pants and adult incontinence products. The articles comprise channels and a wetness indicator.

## BACKGROUND OF THE INVENTION

Absorbent articles for personal hygiene of the type indicated above are designed to absorb and contain body exudates, in particular large quantity of urine. These absorbent articles comprise several layers, for example a topsheet, a backsheet and in-between an absorbent core, among other layers. The function of the absorbent core is to absorb and retain the exudates for a prolonged amount of time, minimize re-wet to keep the wearer dry and avoid soiling of clothes or bed sheets.

The majority of absorbent cores comprise an absorbent material within a core wrap. A first type of commonly used absorbent material is a blend of comminuted wood pulp (so-called "air-felt") with superabsorbent polymers (SAP) in particulate form, also called absorbent gelling materials (AGM). Another type of cores having SAP as absorbent material without cellulose fibers (so called "airfelt-free" cores) has been more recently proposed.

Fluid-distributing channels extending longitudinally have been proposed for both types of cores. The channels can distribute an insulting fluid quickly along a greater area of the absorbent core thus improving fluid acquisition and optimizing absorbent material usage. Channels may also be used to facilitate the folding of the absorbent core in a pre-determined fashion, thus improving the anatomical conformity of the article. Various channel designs have thus been suggested. In air-felt cores, channels may be provided for example by locally embossing the absorbent material. Channels may also be provided by zones substantially free of absorbent material and surrounded by absorbent material. The top layer of core wrap may be attached to the bottom layer of the core wrap through these areas substantially free of absorbent material by a core wrap bond (herein "channel bond"), so that the channels are more resilient to the movement of the wearer or the swelling of the core with a fluid. The core wrap typically comprises one or two layers of a nonwoven synthetic material, typically PP or PE. The channel bonds may be

provided by various means such as gluing, pressure, heat and/or ultrasonic bonding of the core wrap. On the other hand, it is simpler and less costly for the manufacturer to not bond the core wrap through the channels. The presence of channels in an absorbent core can be difficult to recognize before use because modern absorbent articles can be very thin. WO2015/039062 suggests creating a signal to highlight the channels for example by printing a printed adhesive layer between the topsheet and the absorbent core. WO2012/014436A1 discloses a disposable absorbent article having a display area adapted to be visually recognized from both an inner side and an outer side of the article. The liquid absorbent structure is formed with central void and lateral voids. The display area can be visually recognized from the garment-facing side through the central void. The display area may comprise a urine indicator.

## SUMMARY OF THE INVENTION

The present invention is for an absorbent article, such as a diaper or a training pant, as indicated in the claims. The absorbent article of the invention has a wearer-facing side and a garment-facing side and comprises:

- a topsheet on the wearer-facing side,
- a backsheet on the garment-facing side, and
- an absorbent core between the topsheet and backsheet.

The absorbent core comprises a core wrap having a top layer and a bottom layer enclosing an absorbent material and a pair of generally longitudinally-extending channels symmetrically disposed relative to the longitudinal axis of the absorbent article. The article further comprises a wetness indicator at least partially superposed with at least one these channels, as seen from the garment-facing side of the article.

By advantageously placing the wetness indicator at least partially within the area(s) defined by the channel(s) as seen from the exterior of the article, two key features are provided: first, the wetness indicator can react more quickly after a fluid insult's, communicating at an early stage to the caregiver that the diaper has been wetted. The channels allow quicker access for the fluid thereby triggering more quickly the wetness indicator. Second, it is often not recognizable for the user when a dry diaper comprises channels in the absorbent core. Placing the wetness indicator within the area of the channels (as seen from the outside of the article) provide a signal to the user that the product has the channels technology and can provide a signal relative to the size and placements of the channels within the article.

## BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic perspective view of an exemplary absorbent article of the invention in the form a taped diaper as it would be worn on the user;

Fig. 2 is a perspective view of the taped diaper of Fig. 1 after it has been loaded with a liquid;

Fig. 3 is a planar view of the garment-facing side of the diaper of Fig. 1 with the article placed flat;

Fig. 4 is a transversal cross-section of the diaper of Fig. 1;

Fig. 5 is a transversal cross-section of the article taken at the same point as Fig. 4, wherein the absorbent material has swollen as a result of being loaded with a liquid such as urine;

Fig. 6 is a top view of the absorbent core of the article shown in the previous Figures;

Fig. 7 is a planar view of the garment-facing side of an alternative article.

Fig. 8 is a planar view of the garment-facing side of another alternative article.

## DETAILED DESCRIPTION OF THE INVENTION

**Introduction**

As used herein, the terms "comprise(s)" and "comprising" are open-ended; each specifies the presence of the feature that follows, e.g. a component, but does not preclude the presence of other features, e.g. elements, steps, components known in the art or disclosed herein. These terms based on the verb "comprise" should be read as encompassing the narrower terms "consisting essentially of which excludes any element, step or ingredient not mentioned which materially affect the way the feature performs its function, and the term "consisting of which excludes any element, step, or ingredient not specified. Any preferred or exemplary embodiments described below are not limiting the scope of the claims, unless specifically indicated to do so. The words "typically", "normally", "preferably", "advantageously", "in particular" and the likes also qualify features which are not intended to limit the scope of the claims unless specifically indicated to do so.

As used herein, the term "wearer" refers to an incontinent person, which may be an adult, child, or baby, and that will wear the absorbent product. The term "user" refers to the caregiver that applies the absorbent article on the wearer. The "user" may be a parent, a family member in general or a professionally employed caregiver.

The invention will now be further illustrated with reference to the embodiments as described in the Figures. For ease of discussion, absorbent articles and their components such as

the absorbent core will be discussed with reference to the numerals referred to in these Figures. However it should be understood that these exemplary embodiments and the numerals are not intended to limit the scope of the claims, unless specifically indicated. Dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as "40 mm" is intended to mean "about 40 mm".

**General description of the article 20**

As used herein, the term "absorbent articles" refers to disposable products for personal hygiene such as baby diapers, infant training pants or adult incontinence products and the like which are placed against or in proximity to the body of the wearer to absorb and contain exudates discharged from the body, in particular urine. The absorbent articles of the invention will be further illustrated in the below description and in the Figures in the form of a taped diaper. Nothing in this description should be however considered limiting the scope of the claims unless explicitly indicated otherwise.

The absorbent article will now be generally discussed and further illustrated in the form of a baby diaper 20 as exemplarily represented in Fig. 1. Fig. 1 is a perspective view of the exemplary diaper 20 as it would be worn by a user (not represented), with the taped back ends 42 attached on the front of the diaper to the landing zone 44. The garment-facing side of the article constitutes its outer-surface when worn by the wearer and essentially consists of a backsheet layer 25. Typical backsheet comprises a liquid-impermeable film, which may be doubled externally by a softer non-woven layer on its surface. The backsheet film may comprise micro-pores to make the film vapor-permeable. Examples of backsheet layer will be further discussed below.

The diaper is further illustrated in a flattened-out configuration with the taped ends opened and the garment-facing side turned up in Fig. 3. An article that is presented to the user closed such as a training pant may also be represented flattened out by cutting it along its side waists. The absorbent article will typically have a front edge 10, a back edge 12 and the longitudinally-extending lateral side edges 13, 14. The front edge 10 forms the edge of the front waist and the back edge 12 of the back waist, which together when worm by the wearer form the opening for the waist of the wearer. The lateral edges 13, 14 can each form one of the leg openings. The article has a longitudinal direction and a transverse direction defined by the longitudinal axis 80 and transversal axis 90 respectively. The longitudinal axis 80 extends

through the middle of the front and back edges 10, 12 of the article, and thus virtually divides the article in symmetrical left side and right side. The article has a length L along this longitudinal axis between the front and back edges of the article. The transversal axis 90 extends perpendicularly to the longitudinal axis and crosses the longitudinal axis at a position half way between the front edge and the back edge (L/2 from the front and back edges). The crotch point C of the article is herein defined at the point on the longitudinal axis 80 of the article placed at a distance of 2/5 of L from the front edge.

The absorbent articles of the invention comprise at least two generally longitudinally-extending channels 26 in the absorbent core, and at least a wetness indicator 100 visible through the garment-facing area of the article and placed at least partially within the area of the garment-facing side superposed with the channels, as illustrated in Fig. 1 and Fig. 3. When the wearer urinates in the absorbent article, the channels distribute the fluid longitudinally along their length. The wetness indicators which are at least partially superposed with the channels can thus react quicker to a first liquid insult, providing a very early warning to the caregiver that urination has occurred. By "superposed", it is meant that the two elements are positioned in a vertical relation when the article is considered in a flattened configuration as shown in Figs. 3-4. The superposed components may be in direct or indirect contact. The wetness indicator 100 may typically be a color-change composition as illustrated in Figs. 1-2, wherein reference 100' designates the reacted wetness indicator having a different appearance (e.g. color) than the un-reacted wetness indicator 100. Similarly, reference 20' designates the article loaded with some fluid such as urine.

Other layers of the absorbent article are better illustrated in Fig. 4, which shows in cross-section in addition to the liquid permeable topsheet 24 and the liquid impermeable backsheet 25, an absorbent core 28 between the topsheet 24 and the backsheet 25. An optional acquisition and/or distribution layer 54 is represented on the diaper of Fig. 4 together with other typical diaper components. Typical acquisition and/or distribution layers 54 do not comprise SAP as this may slow the acquisition and distribution of the fluid, but an additional layer may also comprise SAP if some fluid retention properties are wished. The prior art discloses many type of acquisition and/or distribution layers that may be used, see for example WO2000/59430 (Daley), WO95/10996 (Richards), US5,700,254 (McDowall), WO02/067809 (Graef).

The absorbent article may typically comprise a pair of partially upstanding barrier leg cuffs 34 and elasticized gasketing cuffs 32 substantially planar with the chassis. Both types of cuffs are typically joined to the chassis of the absorbent article typically via bonding to the

topsheet and/or backsheet. US3,860,003 describes a disposable diaper which provides a contractible leg opening having a side flap and one or more elastic members to provide an elasticized leg cuff (a gasketing cuff 32). US4,808,178 and US4,909,803 issued to Aziz et al. describe disposable diapers having "stand-up" elasticized flaps (barrier leg cuffs 34) which improve the containment of the leg regions. US4,695,278 and US4,795,454 issued to Lawson and to Dragoo respectively, describe disposable diapers having dual cuffs, including gasketing cuffs and barrier leg cuffs. All or a portion of the barrier leg and/or gasketing cuffs may be treated with a lotion. The absorbent article may also comprise other typical components, which are not represented, such as a back elastic waist feature, a front elastic waist feature, transverse barrier cuff(s), a lotion application, etc. . .

**General description of the absorbent core 28**

As used herein, the term "absorbent core" refers to a component used or intended to be used in an absorbent article and which comprises an absorbent material enclosed in a core wrap. As used herein, the term "absorbent core" does not include the topsheet, the backsheet and (if present) any acquisition-distribution layer or multilayer system, which is not integral part of the absorbent core. The absorbent core is typically the component of an absorbent article that has the most absorbent capacity of all the components of the absorbent article, and which comprises all, or at least the majority of, superabsorbent polymer (SAP). The absorbent core may consist essentially of, or consist of, the core wrap, the absorbent material and optionally adhesives. The terms "absorbent core" and "core" are herein used interchangeably.

An exemplary core 28 comprising channels is represented in Fig. 6 in a dry state outside an absorbent article. Absorbent cores can typically be laid flat on a surface as shown on Fig. 6. Absorbent cores may also be typically thin and conformable, so that they can also be laid on a non-flat surface for example a drum during their making process or stored as a continuous roll of stock material before being converted into an absorbent article. For ease of discussion, the exemplarily absorbent core of Fig. 6 is represented in a flat state and extending in a longitudinal direction 80' and a transversal direction 90'. These directions are typically parallel to the corresponding directions of the absorbent article. Unless otherwise indicated, dimensions and areas disclosed herein apply to the core in this flat-out configuration. The same applies to the absorbent article in which the core is integrated.

The absorbent core can typically be generally rectangular with a width W in the transversal direction and a length L'' in the longitudinal direction as measured from edge to edge, including the region of the core wrap which does not enclose the absorbent material, in particular

at the front and back ends 280, 282, which may be or not be sealed. In case the core is not rectangular, the maximum dimension measured along the transversal and longitudinal direction can be used to report the length and width of the core. The width and length of the core may vary depending on the intended usage. For baby and infant diapers, the width W may for example in the range from 40 mm to 200 mm and the length L" from 100 mm to 500 mm, as measured along the longitudinal axis 80 of the core.

The core wrap may comprise a top layer 16 generally forming the top side of the core and a bottom layer 16' generally forming the bottom side of the core wrap. The top and bottom layers may be formed by two separate substrates which may be the same or different material (the top layer being for example hydrophillically treated), but any other known core wrap constructions may also be used, for example wherein the core wrap is formed of a single web wrapped around the absorbent material with one single longitudinal seal. The top and bottom layer can be attached by gluing or otherwise to form at least one C-wrap seal along each of the longitudinally-extending side edges 284, 286 of the core. The material of the top and bottom layers may be a nonwoven web, such as a laminate comprising spunbond ("S") or meltblown ("M") layer. For example spunmelt polypropylene nonwovens are suitable, in particular those having a laminate web SMS, or SMMS, or SSMMS, structure, and having a basis weight range of about 5 gsm to 15 gsm. Suitable materials are for example disclosed in US 7,744,576, US 2011/0268932 Al, US 2011/0319848 A1 and US 2011/0250413 Al. The bottom layer 16' may be inherently hydrophobic but air-permeable, and the top layer 16 may be hydrophillically treated. There may be a seal along the front edge 282 and back edge 280 of the core wrap for better containment of the absorbent material but many cores do not have such transversal seals.

The absorbent material in the core can be of any type, in particular it can comprise wood pulp fibers mixed with superabsorbent polymers or be free of such cellulose fibers ("airfelt-free" core). The first type of core typically comprises from 40% to 80% of superabsorbent polymers (herein abbreviated as "SAP"). For absorbent cores comprising a relatively high proportion of superabsorbent polymer enclosed within the core wrap, the SAP content may represent in particular at least 85%, 90%, 95% and up to 100%, of superabsorbent polymer by weight of the absorbent material. The absorbent material may in particular comprise no or only small amount of cellulose fibers, such as less than 20%, in particular less than 10%, 5% or even 0% of cellulose fibers by weight of the absorbent material. The absorbent material may thus advantageously consist or consist essentially of SAP. The term "superabsorbent polymer" refers herein to absorbent material, which may be cross-linked polymer, and that can typically absorb at least 10

times their weight of an aqueous 0.9% saline solution as measured using the Centrifuge Retention Capacity (CRC) test (EDANA method WSP 241.2-05E). The SAP may in particular have a CRC value of more than 20 g/g, or more than 24 g/g, or of from 20 to 50 g/g, or from 20 to 40 g/g, or from 24 to 30 g/g. The SAP may be typically in particulate forms (superabsorbent polymer particles), but it not excluded that other forms of SAP may be used such as a superabsorbent polymer foam for example. The absorbent core may thus be relatively thin, in particular thinner than conventional cores comprising cellulosic fibers.

The absorbent material 60 defines an absorbent material deposition area 8, as seen from above within the plane of the core from the top side of the absorbent core as shown on Fig. 6. The deposition area comprises the channels 26 encompassed within. The absorbent material deposition area 8 can be generally rectangular, for example as shown in Fig. 6, but other shapes can also be used such as a "T" or "Y" or "sand-hour" or "dog-bone" shape. In particular the deposition area may show a tapering along its width at the crotch region of the core, as illustrated in Fig. 7. In this way, the absorbent material deposition area may have a relatively narrow width in an area of the core intended to be placed in the crotch region of the absorbent article. This may provide for example better wearing comfort.

**Channels 26**

The absorbent cores of the invention comprise a pair of generally longitudinally-extending channels 26 symmetrically disposed relative to the longitudinal axis 80 of the absorbent article. The channels may be provided by various means as is known in the art. Typically, channels may be formed by areas within the absorbent core that are substantially free of absorbent material (as illustrated in Fig. 4 and Fig. 6). By "substantially free" it is meant that in the channel areas the basis weight of the absorbent material is at least less than 25%, in particular at least less than 20% or less than 10%, of the average basis weight of the absorbent material in the rest of the absorbent material deposition area 8. In particular there can be no absorbent material in the channels. Minimal amount such as involuntary contaminations with absorbent material that may occur during the making process are not considered as absorbent material. The channels 26 are advantageously surrounded by the absorbent material, when seen in the plane of the core as seen on Fig. 6, which means that the channels do not extend to any of the edge of the deposition area 8 of the absorbent material.

The top layer 16 of the core wrap may be attached to the bottom layer 16' of the core wrap by core wrap bonds 27 through the channels 26 as illustrated in Fig. 4. As shown in Figs. 4-5, when the absorbent material swells upon absorbing a liquid, the core wrap bond 27 may thus

remain at least initially attached in the channels 26. The absorbent material swells in the rest of the core when it absorbs a liquid, so that the core wrap forms three-dimensional channels 26' along each channel 26 where the core wrap bond 27 is present. The initial channels 26 and the three-dimensional channels 26' can distribute an insulting fluid along their length to a wider area of the core and thus provide a quicker fluid acquisition speed and a better utilization of the absorbent capacity of the core. As the absorbent material swells, the channels 26' become deeper and deep enough (a depth of several mm, e.g. at least 3 mm, as measured on the swollen core) to be visible from the exterior of the article through the backsheet. The three-dimensional channels 26' can also provide a deformation of an overlying layer such as a fibrous layer 54 and provide corresponding ditches 29 in the overlying layer. Channels may also be formed in an absorbent core by area(s) substantially free of absorbent material, but without a core wrap bond. The non-bonded channels will typically form less pronounced three-dimensional channels when wet compared to bonded channels.

When present, the core wrap bond 27 may be continuously extending along the channels 26, but it may also be discontinuous (intermittent) such as series of point bonds. Typically, an adhesive can be used to attach the top layer to the bottom layer of the core wrap through the channels, but it is also possible to bond via other known attachment means, such as pressure bonding, ultrasonic bonding or heat bonding or combination thereof. The core wrap bond may be provided by one or more adhesive material, in particular one or more layers of auxiliary glue (not represented) or layer of fibrous adhesive material, if present in the core, as detailed below. These glues may therefore serve the dual function of immobilizing the absorbent material and attach the top layer and the bottom layer of the core together. The auxiliary glue(s) may be applied by slot coating in a series of thin (e.g. 1mm wide) glue slots in the longitudinal direction.

The following are examples of shape and size of channels, but are not limiting the scope of the invention. In general, the core wrap bond 27 may have the same outline but be slightly smaller than the channels 26 due to the tolerance required in some manufacturing process. The channels 26 may be present within the crotch region of the article, as defined as being the longitudinally middle third of the article. The absorbent core may also comprise more than two channels, for example at least 3, or at least 4 or at least 5 or at least 6.

The channels 26 extend generally longitudinally, which means that each channel area extends at least as much in the longitudinal direction as in the transverse direction, and typically at least twice as much in the longitudinal direction than in the transverse direction (as measured after projection on the respective axis). The absorbent core, as illustrated in Fig. 6, typically also

have a longitudinal axis 80' which is contiguous with the longitudinal axis of the article. The channels 26 may have a length L' projected on the longitudinal axis 80' of the core that is at least 10% of the length L of the absorbent article, in particular from 20% to 80%. The channels 26 may be for example have a length L' of at least 2 cm as measured on the longitudinal axis, or at least 4 cm, 6 cm, 8 cm, or 10 cm, and for example up to 40 cm, or 30 cm. Shorter channels may also be present in the core , for example in the back region or the front region of the core, as seen for example in the Figures of WO2012/170778.

The channels 26 comprise or may consist of a pair of channels symmetrically arranged relative to the longitudinal axis 80 of the article as illustrated by way of example in the Figures. The channels 26 may be curved, in particular they may be concave towards the longitudinal axis 80/80', as for example represented in Figs. 3/6, or they may be completely oriented longitudinally and parallel to the longitudinal axis 80' of the core as illustrated in Fig. 6. For curved channels, the radius of curvature may typically be at least equal (and preferably at least 1.5 or at least 2.0 times this average transverse dimension) to the average transverse dimension of the absorbent material deposition area 8. The channels may be entirely or in part straight but under an angle of (e.g. from 5°) up to 30°, or for example up to 20°, or up to 10° with a line parallel to the longitudinal axis. The radius of curvature may be constant for a channel, or may vary along its length. It is further advantageous that there is no channel superposed or coinciding with the longitudinal axis 80 of the article to avoid the article from folding in this direction. The channels may be advantageously spaced apart from one another over their whole longitudinal dimension. The smallest spacing distance may be for example at least 5 mm, or at least 10 mm, or at least 16 mm, leaving sufficient space there between for the wetness indicator.

Furthermore, in order to reduce the risk of fluid leakages, the channels 26 may advantageously not extend up to any of the edges of the absorbent material deposition area 8, and are therefore surrounded by and fully encompassed within the absorbent material deposition area 8 of the core. Typically, the smallest distance between a channel 26 and the closest edge of the absorbent material deposition area 8 is at least 5 mm. Each channel may have a width Wc along at least part of its length which is at least 2 mm, or at least 3 mm or at least 4 mm, up to for example 20 mm, or 16 mm or 12 mm. The width Wc of each channel 26 may be constant through substantially its whole length or may vary along its length.

Three-dimensional channels 26' in the absorbent core start forming when the absorbent material absorbs a liquid such as urine and starts swelling. As the core absorbs more liquid, the depressions formed by these channels will become deeper and more apparent to the eye and the

touch from the exterior of the article as the backsheet is pushed outwardly by the expending absorbent material, as illustrated in Figs. 2/5. If the core wrap bond 27 is sufficiently strong and the level of SAP not too high, it is possible that the core wrap bonds remain permanent until complete saturation of the absorbent material. On the other hand, the core wrap bonds may in some cases also restrict the swelling of the absorbent material when the core is substantially loaded. The inventors have thus found that the core wrap bond 27 may also be designed to open in a controlled manner when exposed to a large amount of fluid. The bonds may thus remain substantially intact at least during a first phase as the absorbent material absorbs a moderate quantity of fluid. In a second phase the core wrap bonds 27 in the channels can start opening to provide more space for the absorbent material to swell while keeping most of the benefits of the channels such as increased flexibility of the core in transversal direction and fluid management. In a third phase, corresponding to a very high saturation of the absorbent core, a more substantial part of the channel bonds can open to provide even more space for the swelling absorbent material to expand. The strength of core wrap bond 27 within the channels can be controlled for example by varying the amount and nature of the glue used for the attaching the two sides of the core wrap, the pressure used to make the core wrap bond and/or the distribution of the absorbent material, as more absorbent material will usually causes more swelling and will put more pressure on the bond. The extensibility of the material of the core wrap may also play a role.

**Wetness indicator 100**

The absorbent article 20 comprises a wetness indicator 100 which is visible from the garment-facing side of the article and which changes appearance when contacted with a body exudates, in particular urine. The wetness indicator may comprise a single area but it also may comprise several areas. For example, when the absorbent article comprises two channels, the absorbent article may comprise the wetness indicator in two areas, one for each channel. Within one channel area, the wetness indicator may also comprise a single area as illustrated in Fig. 3, but it is also possible that the wetness indicator may be comprised by a plurality of wetness indicator areas lOOp as illustrated in Fig. 7. The later may allow printing more aesthetically pleasing pattern for example with animal shapes, geometrical shapes such as triangle, square or circles, or object shapes like toys, cars, etc.. Herein, the term "wetness indicator" will thus be used independently of the numbers of discrete wetness indicator areas present and visible through the garment-facing side.

The wetness indicator 100 is at least partially superposed with the areas defined by the channels, when seen from the garment-facing side as in Fig. 3. By "superposed", it is meant that

the wetness indicator is at least partially positioned vertically congruent in the areas defined by the channels, when the article is considered in a flattened configuration as shown in Figs. 3-4. By "as seen from the garment-facing side of the article", it is meant that although the wetness indicator 100 may not be placed directly in the plane of the channels 26 or even within the core 28, when considering the article 20 from the outside, that is typically looking at the outward surface of the backsheet as shown on Fig. 1, the wetness indicator appears at least partially placed within the channels 26. As the three-dimensional channels 26' are typically visible from the outside of the article when the article is sufficiently loaded with urine, as shown in Fig. 2, the wetness indicator also typically appears placed within the three-dimensional channels 26' in the loaded article when seen from the exterior of the article. The word "seems" should be construed herein in a broad sense, as in some embodiments, the wetness indicator may comprise or consists of an appearing signal or a disappearing signal, so that the wetness indicator is only visible to an observer in the wet or dry state, as will be exemplified further below. This arrangement according to the invention provides for a quicker reaction of the wetness indicator to an insulting fluid. The wetness indicator also serves to indicate the position of the channels to the user of the article. The channels 26 may otherwise not be immediately recognizable in a dry article. The wetness indicator may be further typically placed between the backsheet and the absorbent core, i.e. between the bottom layer of the core wrap of the absorbent core and the backsheet, typically the polymeric film layer that constitutes at least part of the backsheet.

The wetness indicators of the present invention may be according to any wetness indicating system known in the art. It is known that wetness indicator can provide an appearing signal, a disappearing signal or a color change signal, and of course combinations thereof. Typically, a color change signal will be used, examples of which will be more detailed below.

An appearing signal will typically not be visible or more generally perceivable in the dry article, and becomes visible or otherwise perceivable when the article is wet. An appearing signal may for example be provided by a composition which is transparent or having a color that matches the color of the backsheet material, which is typically white, in its dry state, and then changes to a different color when contacted with urine. Other appearing wetness indicator may also be elements capable of providing a physical sensation indicating a fullness level of the absorbent assembly. Examples of such elements are disclosed in WO2008/132630 and include a temperature change element (cooling or heating element), a pressure-inducing element or a foam-producing element.

The wetness indicator may provide a disappearing signal when the article is wet. A disappearing signal may be provided by a composition that a first color when dry and which changes to a second color that matches the general color of the backsheet or any graphic printed on the backsheet, so that the second color is less discernible that the first color on the article. Such a disappearing signal may be provided for example by a composition comprising a dye that dissolves in urine and thus fades as the article is wetted.

The wetness indicator may advantageously provide a color change signal, which may be typically obtained by a composition having a first color when dry and a second color different form the first color when wet, both colors being discernible by an external observer considering the article in a dry and a wet state. The wetness indicator may in particular be a color change composition comprising a suitable pH indicator or another chemical substance that changes color when contacted with urine. Such compositions are for example disclosed in WO03/070138A2, WO2010/120705 (Klofta) or US2012/165771 (Ruman). The documents cited previously give several examples of such suitable pH indicator, which for example include bromocresol green, bromocresol purple, bromophenol blue, m-cresol purple, cresol red, chlorophenol red, bromothymol blue, bromopyrogallol red, bromoxylenol blue, acridine, or acridine orange, thymolphthalein, thymol blue, xylenol blue, bromochlorophenol blue and indigo carmine. Bromocresol green for example may be applied in a composition having an acid stabilizer so that the pH indicator appears yellow on a dry article and turns to a green-blue shade when contacted with urine, the typical pH of urine being around pH 7.

More generally, the wetness indicator compositions of the invention may be as disclosed in WO2010/120705 (Klofta) and comprises a colorant, a matrix and a stabilizer. The colorant has an initial color state, which is associated with a first state of the wetness indicator composition. Examples of this first color state include, but are not limited to, colors visible to the human eye, such as, red, blue, green, indigo, violet, yellow, orange, purple, and the like; colors not visible to the human eye, such as, colors visible in the ultra violet (or UV), or infra red (or IR) portion of the electromagnetic spectrum, and the like. The first color state may be invisible, white, black, translucent or opaque. The colorant(s) also has a final color state, which is associated with a second state of the wetness indicator composition. Examples of this second color state include, but are not limited to, colors visible to the human eye, such as, red, blue, green, indigo, violet, yellow, orange, purple, and the like; colors not visible to the human eye, such as, colors visible in the UV, or IR portion of the electromagnetic spectrum, and the like. The second color state may be invisible, white, black, translucent, opaque, or have a change in intensity or visual

distinctiveness, and the like, when compared to the first color state. The initial color state of the colorant is different, in some form, to the final color state. For example, the initial color state may be a first color, such as, yellow, while the second color state may be a different color, such as blue; or the initial color state may be a first color, such as, blue, while the second color state may be transparent, such as, a color not visible to the human eye, and only visible in the UV portion of the electromagnetic spectrum. In an optional embodiment of the present invention the wetness indicator composition may comprise two or more colorants. The colorant may be employed in compositions at levels which are effective at indicating the presence of a liquid, and include from about 0.001% to about 5%, from about 0.005% to about 2%, and from about 0.01% to about 1%, and even from 0.01% to 0.5% by weight of the composition.

The wetness indicator compositions may comprise a matrix which acts to hold the colorant in place before, during and after contact with liquid. The matrix of the present invention may be highly resistant to colorant leaching, and may be resistant to premature activation in high humidity environments. Upon contact with liquid, such as urine, menses, blood or the like, the matrix allows sufficient liquid to contact the colorant and effect a change in appearance. The matrix concurrently aids in inhibiting the colorant, in either its initial color state or final color state, from leaching out of the matrix into the surrounding environment, such as, the absorbent core of a disposable absorbent article. When the wetness indicating composition is attached to a substrate, the matrix and consequently the composition, should have sufficient wet and dry cohesion, adhesion, and/or flexibility to remain fully retained on the substrate. Such a matrix may include a first and second binding agents, as disclosed in details in WO2010/120705 and may be employed in wetness indicator compositions at levels which are effective at immobilizing and stabilizing the colorant, including from about 5% to about 95%, from about 10% to about 80%, and from about 25% to about 75%, by weight of the composition.

The first binding agent may be any material which immobilizes the colorant when the colorant is in its initial color state. There are various materials which may be suitable for use as the first binding agent for the wetness indicating compositions of the present invention. The material selected as the first binding agent will be any material which immobilizes the colorant when in its first color state. Possible first binding agents include, but are not limited to, rosins, rosin esters, polymerized rosins, pentaerythritol rosin esters, styrenated terpenes, polyterpene resins, terpene phenolics, and combinations thereof. The first binding agent may be employed in compositions at levels which are effective at immobilizing and stabilizing the colorant in its first

state, including from about 4% to about 90%, from about 10% to about 75%, and from about 20% to about 65%, by weight of the composition.

The second binding agent may be any material which immobilizes the colorant when the colorant is in its final color state. There are various materials which may be suitable for use as the second binding agent for the wetness indicating compositions of the present invention. The second binding agents may be selected from, but are not limited to those second binding agents disclosed in USPN 6,904,865 to Klofta. The second binding agent may be selected from the group consisting of quaternary ammonium salt compounds, cationic clay, polyacrylic acid polymers, organic acids, and combinations thereof. Examples of suitable quaternary ammonium compounds include, but are not limited to, dimethyl(2- ethylhexylhydrogenatedtallowalkyl) ammonium methyl sulfate, cocoalkylmethyl[ethoxylated(15)] ammonium chloride, dodecyltrimethyl ammonium chloride, hexadecyltrimethyl ammonium methyl sulfate, octadecyltrimethyl ammonium chloride, dicocoalkyldimethly ammonium chloride, di(hydrogenated tallowalkyl)dimethyl ammonium chloride, and distearyldimethyl ammonium chloride. It should be noted that the counter anion associated with the quaternary compound, or any second binding agent having one or more cationic group, is not specifically limited to chloride. Other anions can also be employed and non-limiting examples include methyl sulfate and nitrite. Similarly, any suitable counter cation, such as, but not limited to, sodium, potassium, calcium, magnesium, zinc, protons, ammonium, substituted ammonium and the like, may be associated with a second binding agent having one or more anionic groups.

Wetness indicator compositions may further include a stabilizer, as detailed e.g. in WO2010/120705. It may be desirable to include a stabilizer when the colorant is a pH indicator and when the absorbent article could be stored under conditions of high humidities and temperatures. The inclusion of a stabilizer within the wetness indicator composition is also especially important for new diaper designs where materials and/or chemicals are present that could potentially prematurely activate the color change of the colorant within the wetness indicator composition. The stabilizer may be an acidic or a basic stabilizer The inclusion of a stabilizer, while not wishing to be limited by theory, is believed to play a role in stabilizing the colorant against premature changes caused by exposure to humid environments and/or certain components of the diaper, by maintaining a stable pH, such as a low pH environment with an acidic stabilizer, around the colorant even when the system is exposed to high humidities and/or certain components of the diaper. This maintenance of a stable pH environment keeps the colorant, especially when the colorant is a pH indicator, in its initial dry color state. The

stabilizer, when present is typically employed in compositions at levels which are effective at stabilizing the colorant, from about 0.001% to about 30%, from about 0.1% to about 15%, and also from about 1% to about 10%, by weight of the composition.

The color change composition may further be a hot-melt adhesive, which allows for an easy application of the composition on a substrate component of the article for example by a slot coating process, inkjet printing or in particular printed adhesive coating, as for example disclosed in US20 11/274834 (Brown). A printed adhesive coating allows in particular the precise placement of a hotmelt composition comprising a wetness indicator agent in selected areas of a substrate such as the inwardly facing surface of the backsheet layer of the article. US8186296 (Brown) discloses an apparatuses that can be used to apply viscous fluids, such as adhesives comprising a color change agent, in pre-determined patterns to an advancing substrate. The fluid application apparatus may include a slot die applicator and a substrate carrier. The substrate carrier may include one or more pattern elements and may be adapted to advance the substrate past the slot die applicator as the slot die applicator discharges adhesive onto the substrate. In operation, the substrate is disposed on the substrate carrier; the substrate carrier advances the substrate past the slot opening of the slot die applicator. In turn, the substrate is intermittently compressed between the slot die applicator and the pattern surface of the pattern element. As the substrate is intermittently compressed, adhesive discharged from the slot die applicator is applied onto the substrate in an area having a shape substantially the same as a shape defined by the pattern surface.

A hot melt adhesive composition may typically become fluid at a temperature of above 60°C and solidifies when it touches the substrate on which it is applied as it cools down. Hot-melt adhesives may include one or more polymers to provide cohesive strength (e.g., aliphatic polyolefins such as ethylene-propylene copolymers, polyetheramides, polyetheresters, and combinations thereof; ethylene vinyl acetate copolymers; styrene-butadiene or styrene-isoprene block copolymers; etc.), a resin or analogous material (sometimes called a tackifier) to provide adhesive strength (e.g., hydrocarbons distilled from petroleum distillates; rosins and/or rosin esters; terpenes derived, for example, from wood or citrus, etc.); and optional waxes, plasticizers or other materials to modify viscosity (e.g., mineral oil, polybutene, paraffin oils, ester oils, and the like), and/or other additives including, but not limited to, antioxidants or other stabilizers. The matrix may comprise a first and a second binding agent. The matrix acts to hold the colorant in place before, during and after contact with liquid.

More generally, hot-melt wetness indicators of the invention (HMWI) may comprise a pH sensitive colorant (pH Indicator), a water insoluble component (resin/tackifier), a wetting agent (polymer, surfactant), a stabilizing agent (acid), a rheology modifier and anti-oxidants for example in the following range in weight percent:

| | |
|---|---|
| pH Indicator (e.g. Bromocresol green) | < 0.5 |
| Tackifier | 25-45 |
| Surfactant | 10-20 |
| Water-soluble polymer | 00-10 |
| Fatty acids | 30-50 |
| Plasticizer | 00-10 |

The wetness indicator composition may be applied on any layer of the absorbent article using a conventional technique, for example printing, spraying or coating, or printed adhesive coating as indicated previously, during the making of the absorbent article. The layer may advantageously be the inner surface of the backsheet or the outer surface of the bottom layer of the core wrap. This allows the wetness indicator to be visible from the exterior of the article by transparency through the backsheet while keeping the wetness indicator composition within the article. The wetness indicator may in particular be easily applied on a layer such a nonwoven or film by a slot-coating process especially if the composition is can be applied as a hot-melt. The slot-coating process allows applying a well-defined slot or a series of slots extending in the machine direction of the converting line, which is typically parallel to the longitudinal direction of the article. Such a slot 100 of wetness indicator composition is for example shown on Fig. 8, in the form of the two longitudinally extending wetness indicator areas 100, each present within an equally longitudinally extending channel 26.

The wetness indicator may be smaller, longer, thinner, wider or of an equal length or width than each of the channels 26 where it is present. It may be typically advantageous to have a relatively long wetness indicator, for example at least 10 cm long, so as to give to the caregiver a better indication of the amount or repartition of the fluid in the article. The wetness indicator may be entirely encompassed in the area of defined by the channels 26 as shown in the Figures, but it is also not excluded that the wetness indicator may be partially situated outside the channels.

**Method of making the article - Relations between the layers**

The absorbent articles of the invention may be made by any conventional methods known in the art. In particular the articles may be hand-made or industrially produced at high speed. Typically, adjacent layers and components will be joined together using conventional bonding

method such as adhesive coating via slot coating or spraying on the whole or part of the surface of the layer, or thermo-bonding, or pressure bonding or combinations thereof. This bonding is exemplarily represented for the bond 27 between the core wrap layers within the channels 26. Other glues or attachments are not represented for clarity and readability but typical bonding between the layers of the article should be considered to be present unless specifically excluded. Adhesives may be typically used to improve the adhesion of the different layers, for example between the backsheet and the core wrap. The glues used may be any standard hotmelt glue as known in the art.

The absorbent core 28 and in particular its absorbent material deposition area 8 may or may not be at least as large and long and advantageously at least partially larger and/or longer than a fibrous acquisition and/or distribution layer 54. This is because the absorbent material in the core can usually more effectively retain fluid and provide dryness benefits across a larger area than the fibrous layer 54. The absorbent article may have a rectangular SAP layer and a non-rectangular (shaped) fibrous acquisition/distribution layer. The absorbent article may also have a rectangular (non-shaped) fibrous layer and a rectangular layer of SAP.

MISC

The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as "40 mm" is intended to mean "about 40 mm."

# CLAIMS

What is claimed is:

1. An absorbent article (20), such as a diaper or a training pant, having a wearer-facing side and a garment-facing side and a longitudinal axis (80); the absorbent article comprising:
- a topsheet (24) on the wearer-facing side,
- a backsheet (25) on the garment-facing side, and
- an absorbent core (28) between the topsheet and backsheet; the absorbent core comprising a core wrap having a top layer (16) and a bottom layer (16') enclosing an absorbent material (60), wherein the absorbent core comprises a pair of generally longitudinally-extending channels (26) symmetrically disposed relative to the longitudinal axis (80) of the absorbent article

characterized in that the absorbent article further comprises a wetness indicator (100) at least partially superposed with at least one of the channels, as seen from the garment-facing side of the article.

2. An absorbent article according to claim 1, wherein the wetness indicator is placed between the bottom layer of the core wrap and the backsheet.

3. An absorbent article according to any of the preceding claims, wherein the wetness indicator comprises a composition that changes appearance when contacted with urine, in particular a composition comprising a pH indicator and/or a water soluble dye.

4. An absorbent article according to the preceding claim, wherein the composition is slot coated or printed on a component of the absorbent article, in particular on the side of the backsheet facing the absorbent core.

5. An absorbent article according to claim 4, wherein the urine indicator comprises a single wetness indicator area (100) in at least one of the channel where the wetness indicator is present.

6. An absorbent article according to claim 4, wherein the urine indicator comprises two or more wetness indicator areas (lOOp) in at least one of the channel where the wetness indicator is present.

7. An absorbent article according to any of the preceding claims, wherein the absorbent core does not comprise a channel superposed with the longitudinal axis (80).

8. An absorbent article according to any of the preceding claims, wherein the channels are straight and oriented parallel to the longitudinal axis of the absorbent article, or wherein the channels are curved, in particular concavely curved towards the longitudinal axis of the absorbent article.

9. An absorbent article according to any of the preceding claims, wherein the channels are areas of the absorbent core substantially free of absorbent material (60), in particular wherein the top layer of the core wrap is bonded to the bottom layer of the core wrap through at least one of the channel(s).

10. An absorbent article according to any of the preceding claims, wherein the absorbent material comprises at least 70%, in particular at least 80% and up to 100% of superabsorbent polymer particles by weight of the absorbent material.

11. An absorbent article according to any of the claims 1-9, wherein the absorbent material comprises from 40% to 80% of superabsorbent polymer particles by weight of the absorbent material.

12. An absorbent article according to any of the preceding claims, wherein at least one channel has a length (L') projected on the longitudinal axis (80) of the article which is at least 10% of the length (L) of the absorbent article and/or at least 2 cm long.

13. An absorbent article according to any of the preceding claims, wherein at least one channel has a width (Wc) of at least 2 mm, in particular from 2 mm to 20 mm, at least in some of its part.

14. An absorbent article according to any of the preceding claims, wherein the periphery of the absorbent material (60) within the core wrap defines an absorbent material deposition area (8), and wherein the absorbent material deposition area is either rectangular or is shaped with a width narrower at the crotch point (C) than the maximum width of the absorbent material deposition area in the rest of the core, wherein the crotch point is defined as the point on the longitudinal axis (80) of the core and placed at a distance of two fifth (2/5) of L from the front edge (10) of the absorbent article, L being the length of the absorbent article measured along its longitudinal axis (80).

15. An absorbent article according to any of the preceding claims, wherein the core comprises an auxiliary glue between the absorbent material (60) and the top layer (16) and/or between the absorbent material and the bottom layer (16') of the core wrap.

Fig. 1

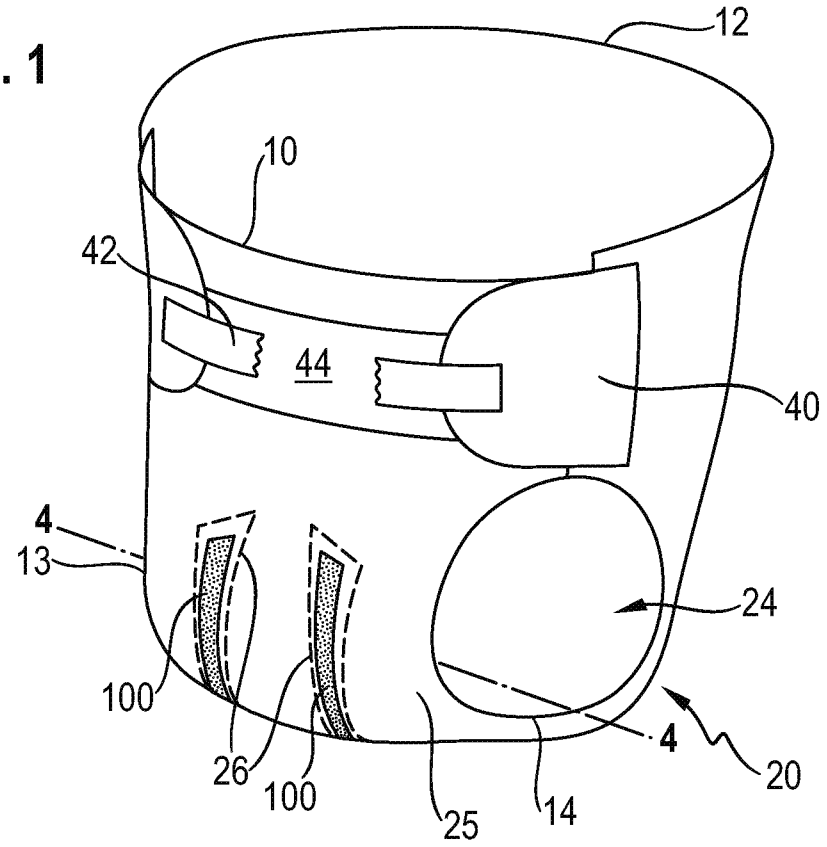



Fig. 2

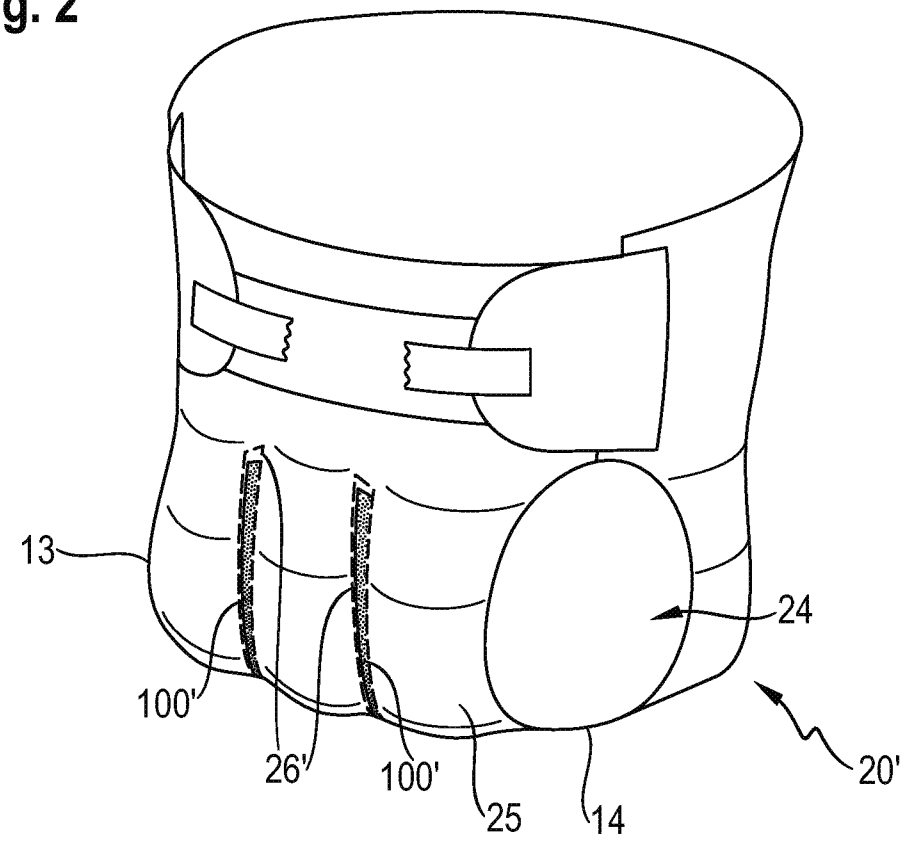
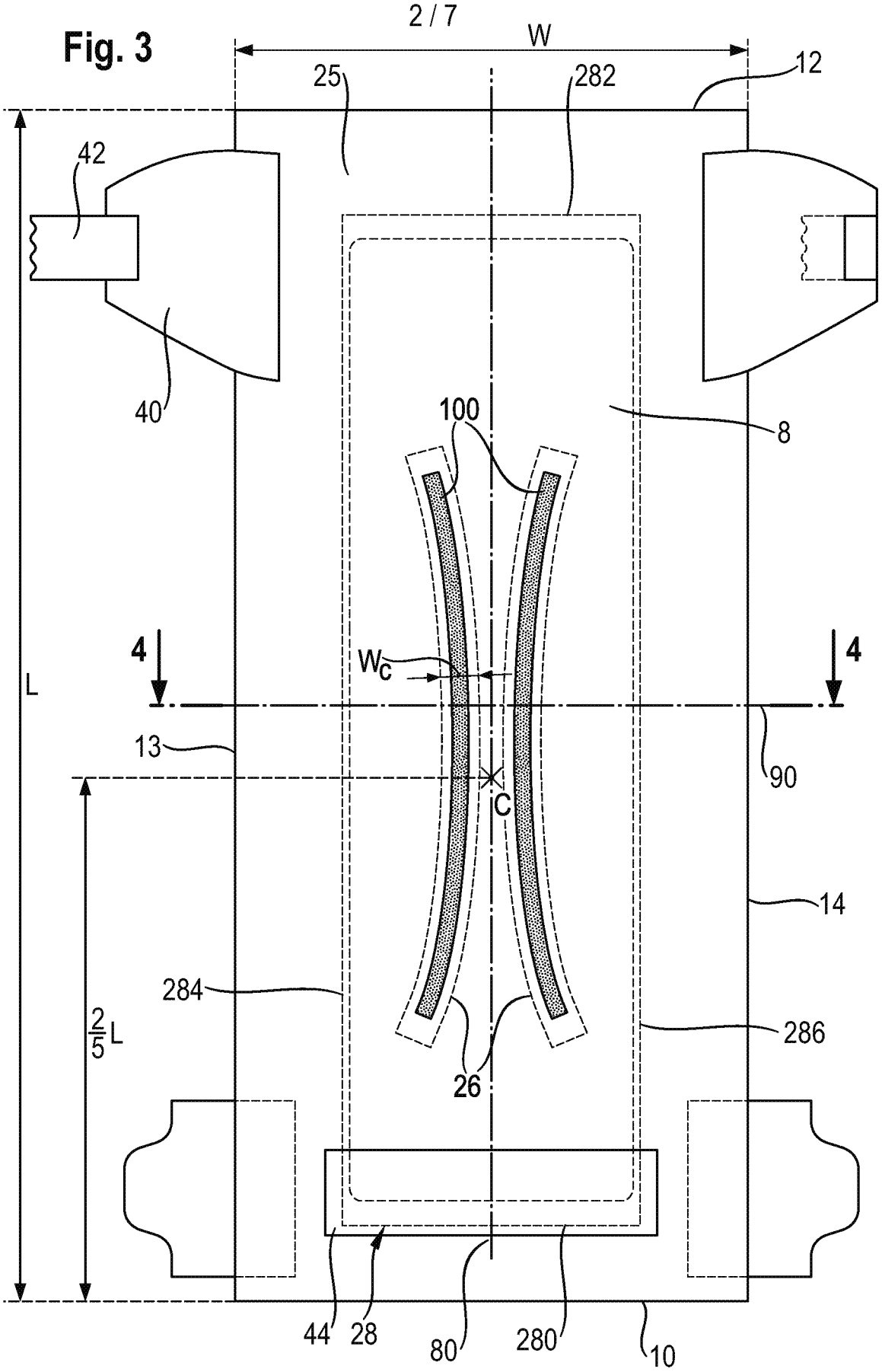


Fig. 3


W
25
282
12
42
40
100
8
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4
$W_C$
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90
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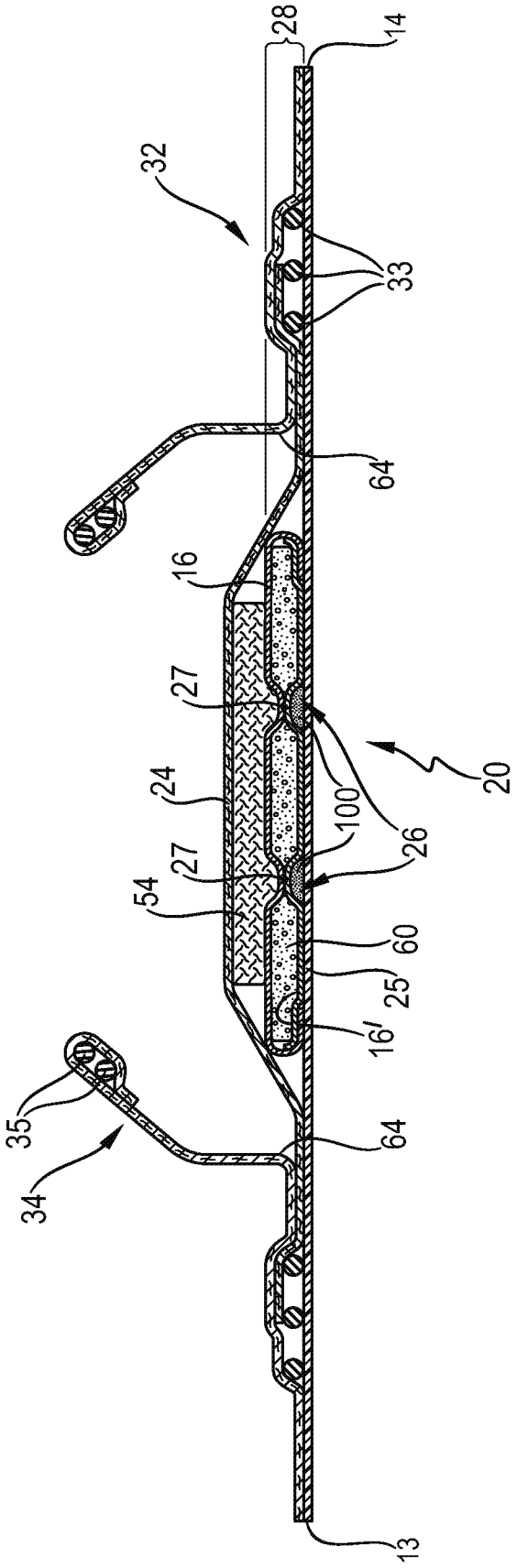
280
10

Fig. 4



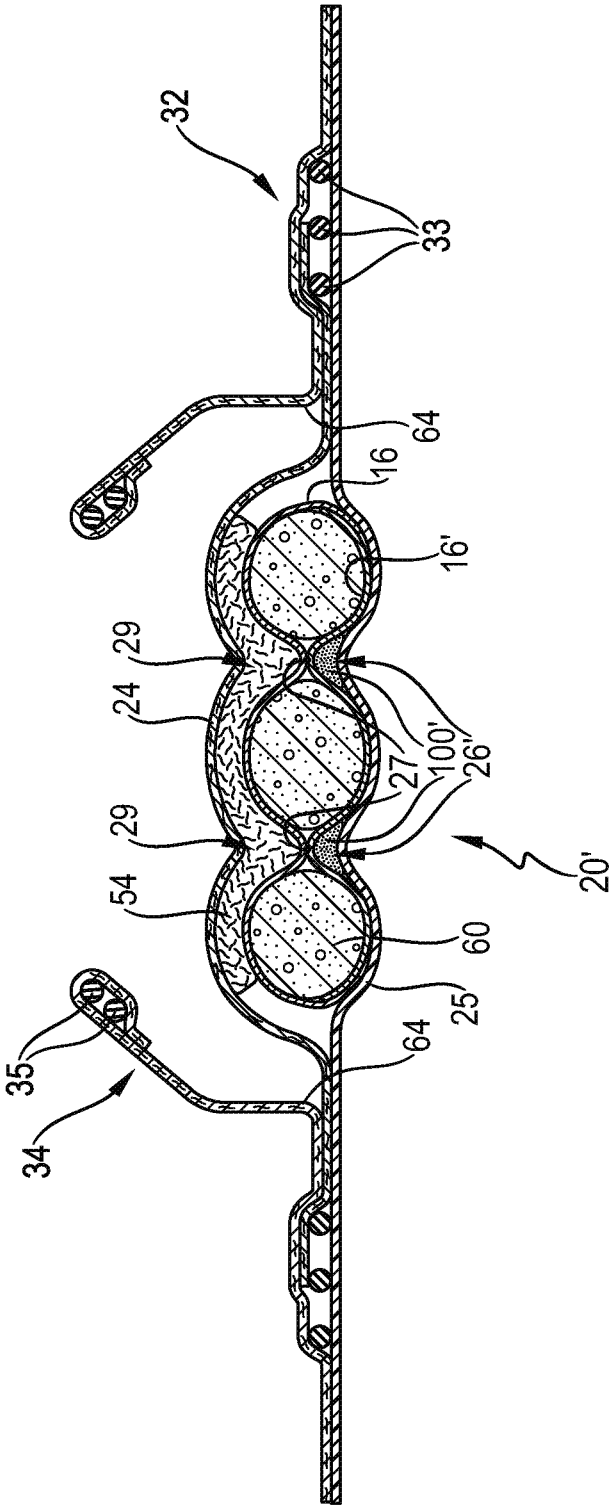



Fig. 5

Fig. 6

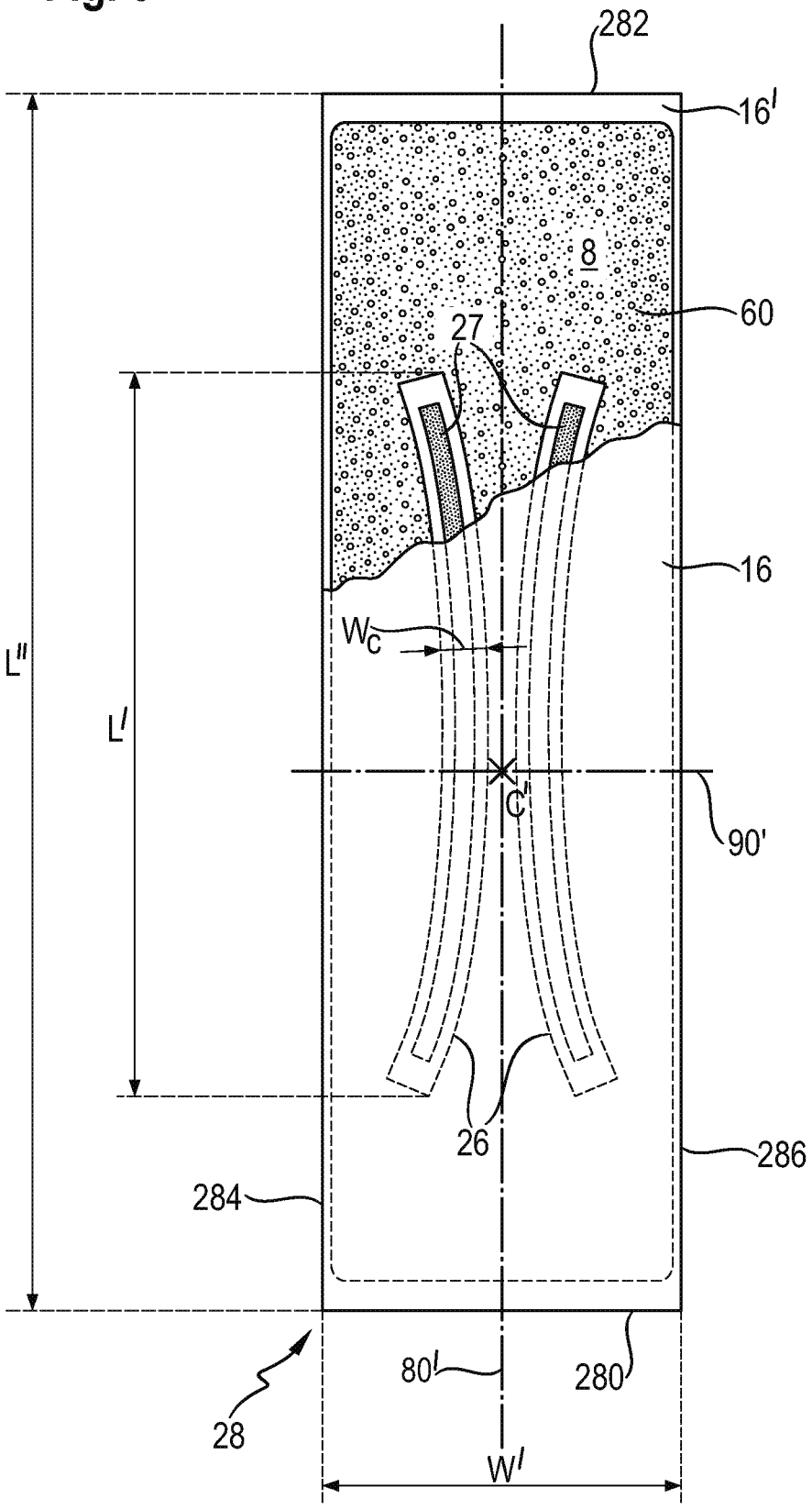


Fig. 7

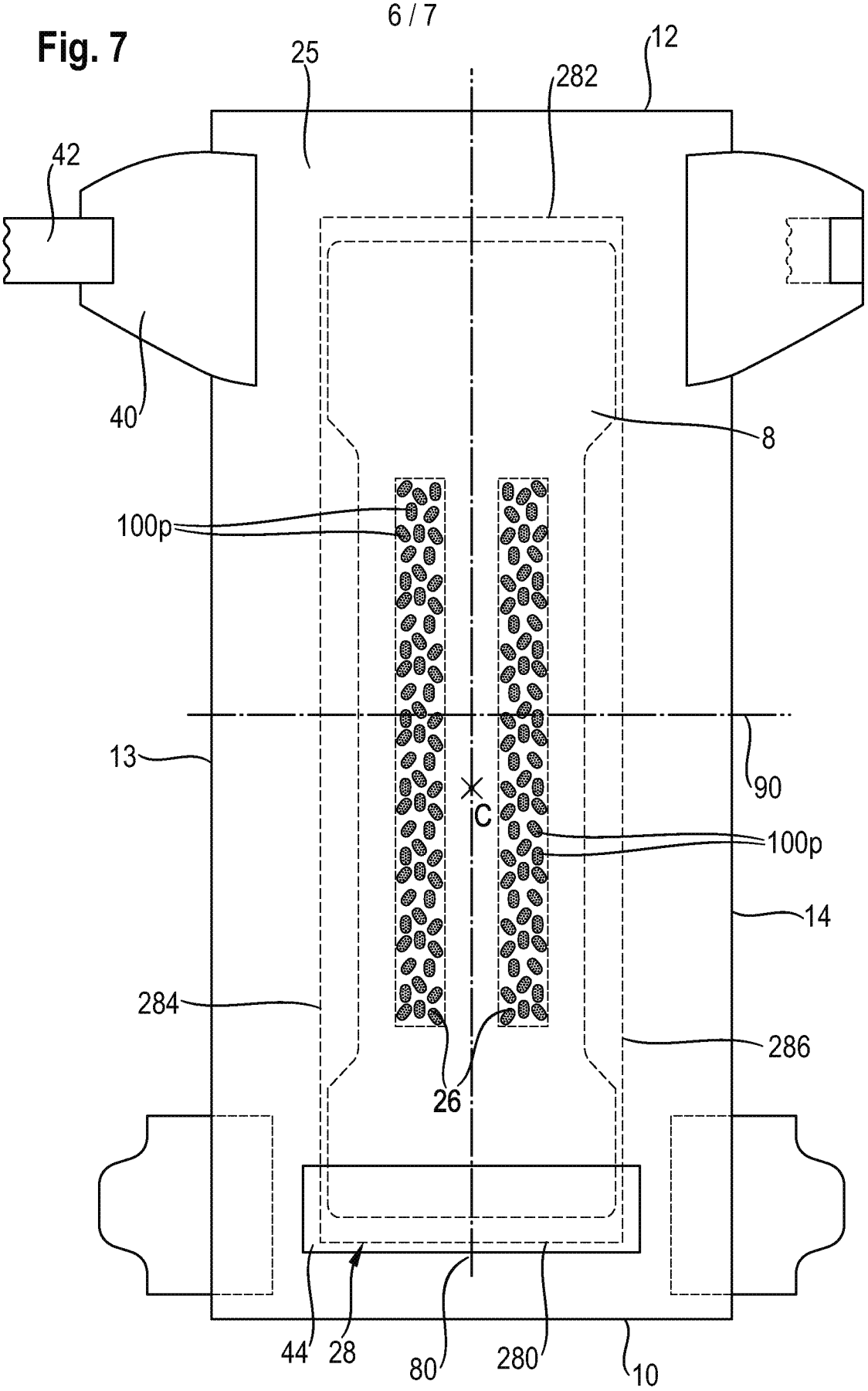
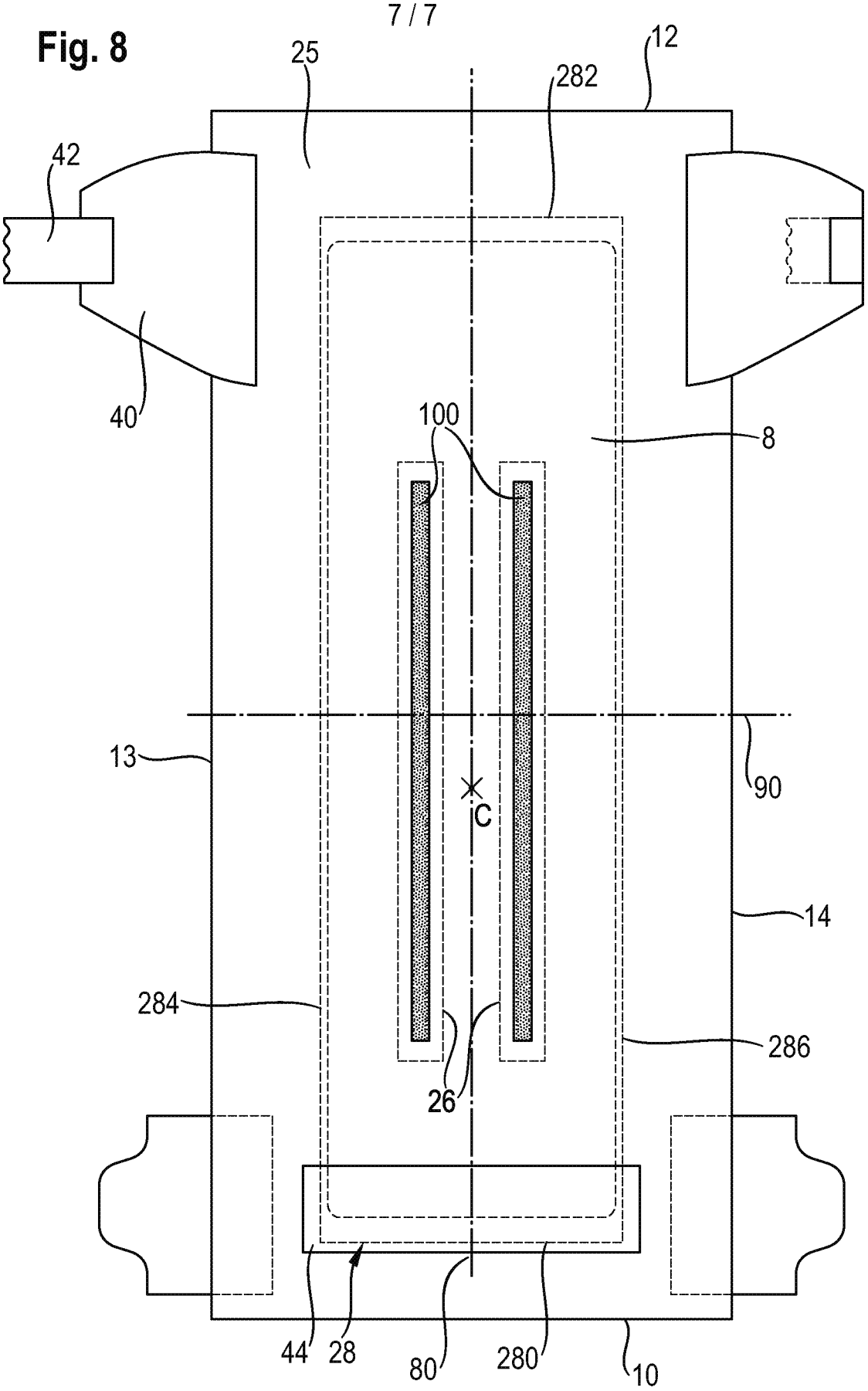


Fig. 8



# INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/033855

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61F13/49 A61F13/514 A61F13/532 A61F13/42
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61F

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal , WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
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X Further documents are listed in the continuation of Box C.

X See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 29 July 2016 | 08/08/2016 |

| Name and mailing address of the ISA/ | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>Fax: (+31-70) 340-3016 | Demay, Stephane |

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Form PCT/ISA/210 (second sheet) (April 2005)

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International application No
PCT/US2016/033855

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Information on patent family members

International application No
PCT/US2016/033855

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