

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ATTENDS HEALTHCARE PRODUCTS, INC.

PETITIONER

v.

PAUL HARTMANN AG

PATENT OWNER

PATENT 8,152,788
PATENT 8,784,398
PATENT 8,771,249
PATENT 8,708,990

DECLARATION OF ARRIGO D. JEZZI

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LIST OF DOCUMENTS CONSIDERED

Exhibit	Shorthand	Description
1001	'788 Patent	U.S. Patent No. 8,152,788
	'398 Patent	U.S. Patent No. 8,784,398
	'249 Patent	U.S. Patent No. 8,771,249
	'990 Patent	U.S. Patent No. 8.708,990
1002	Benning	U.S. Patent App. Pub. No. 2005/0256496
1003	Karami '772	U.S. Patent App. Pub. No. 2006/0058772
1004	Karami '626	U.S. Patent App. Pub. No. 2003/0220626
1005	Miyamoto '499	U.S. Patent App. Pub. No. 2004/0016499
1006	Kleinschmidt	U.S. Patent No. 6,547,773
1007	Jacobs	U.S. Patent No. 5,814,178
1008	Anderson	U.S. Patent No. 6,605,172
1009	Stupperich	Certified Translation of German Patent Application DE 10 2004 053 469 A1, Certificate of Translation, and Original German-Language Document
1010	Mandzsu	WO Patent Pub. No. 2006/099000
1011	Cree	U.S. Patent No. 6,255,236
1013	EDANA	Davis Dyer, <i>Seven Decades of Disposable Diapers: A Record of Continuous Innovation and Expanding Benefit</i> (EDANA, Aug. 2005)
1014	Huggies	USA Volume 2 Huggies
1015	Glaug	U.S. Patent No. 6,514,233
1016	Rohrl	U.S. Patent App. Pub. No. 2006/0282053
1017	Karami '341	U.S. Patent App. Pub. No. 2001/0023341
1018	Fries	U.S. Patent No. 5,549,592
1019	McCormack	U.S. Patent No. 5,695,868
1020	Horn	U.S. Patent App. Pub. No. 2004/0158957
1021	INDA Glossary	INDA Nonwovens Glossary (INDA 2002)
1022	Young	U.S. Patent No. 5,626,571
1023	Sun	U.S. Patent No. 6,852,904
1024	Zoia	U.S. Patent No. 5,053,028
1025	Braverman	WO Patent Pub. No. 2006/071211
1026	Neugebauer	U.S. Patent App. Pub. No. 2007/0134489
1027	Igaue	U.S. Patent App. Pub. No. 2004/0236303
1028	Damaghi	U.S. Patent App. Pub. No. 2005/0261650
1029	O'Connell	U.S. Patent No. 6,235,011
1030	Karami '584	U.S. Patent App. Pub. No. 2001/0042584

1031	Miller	U.S. Patent No. 5,845,375
1034	ASTM D5169	ASTM D5169-98 (1998)
1035	ASTM D5170	ASTM D5170-98 (1998)
1036	Miyamoto '930	U.S. Patent 6,840,930
1037	Couillard	U.S. Patent App. Pub. No. 2002/0174931
1039	Brady	U.S. Patent No. 6,843,949
1040	Gorman	U.S. Patent No. 5,256,231
1041	Tao	U.S. Patent No. 6,569,136
1042	Roe	U.S. Patent App. Pub. No. 2004/0224132
1044	Gehring	U.S. Patent No. 6,854,297
1045	Fernfors	U.S. Patent App. Pub. No. 2002/0193776
1046	Huang	European Patent No. EP0734243B1
1047	Hari	<i>Types and properties of fibres and yarns used in weaving</i> , P.K. Hari, Chapter 1 of K.L. Gandhi, <i>Woven Textiles Principles, Technologies and Applications</i> (Series in Textiles, 2012, pg. 3-34)
1048	Chhabra	U.S. Patent App. Pub. No. 2004/0137200
1049	Kauschke	U.S. Patent No. 6,537,644

DECLARATION OF ARRIGO D. JEZZI

1. My name is Arrigo “Rick” Jezzi. I am over the age of twenty-one (21) years, of sound mind, and capable of making the statements set forth in this Declaration. I am competent to testify about the matters set forth herein. All the facts and statements contained herein are within my personal knowledge and they are, in all things, true and correct.

2. I have been asked by Attends Healthcare Products, Inc. to submit this declaration in support of its challenge to the validity of certain claims of U.S. Patent No. 8,152,788 (the “788 Patent”), U.S. Patent No. 8,784,398 (the “398 Patent”), U.S. Patent No. 8,771,249 (the “249 Patent”), and U.S. Patent No. 8,708,990 (the “990 Patent”) (collectively, the “Diaper Patents”).

I. PROFESSIONAL BACKGROUND

3. My *curriculum vitae* is attached as Attachment A.

4. I hold a Bachelor’s degree in Chemical Engineering, which was conferred on me by Drexel University in Philadelphia in 1970. Since receiving my engineering degree, I have worked in the paper, nonwoven, and absorbent care products industries, with over 35 years of experience in disposable absorbent products and nonwovens.

5. Between 1983 and 1993 I worked for Kimberly-Clark Corporation, where I supervised the development of feminine care sanitary products, adult

incontinence products, and baby diapers. For at least five years at Kimberly-Clark, I was the Director of Research & Development in both Baby Care and Adult Care where I was responsible for product development, process development, and material development for these categories of products. Products I was involved with at Kimberly-Clark included the Huggies® Supreme diapers (the first disposable baby diaper to include a cloth-like backsheet whose commercialization I was responsible for), the Depend® line of incontinence products, and Poise® bladder control pads (which I conceived, developed, and commercialized). My work there also included the development and commercialization of nonwoven materials for use in disposable absorbent products.

6. Between 1993 and 1999, I worked as Vice President of Research & Development for Confab, Incorporated and Paragon Trade Brands, which were two of the largest private label companies manufacturing and selling disposable absorbent incontinence products. At these companies, I developed and commercialized personal care absorbent products such as the White Cloud® diaper and implemented cost-savings programs.

7. I completed my corporate career at Clopay Plastic Products Company, where I was responsible for technology and product development for printed microporous films, elastomeric films, and nonwoven and film laminates for

disposable absorbent products. The primary product produced by Clopay was polyethylene films for diaper backsheets.

8. Since my retirement, I opened my own consultancy focusing on products, materials, and processes used in the disposable absorbent industry and have served as an independent consultant for over 110 clients in these areas, including product development, process development, and material (e.g., nonwoven) development in baby, adult, and feminine care. My consultancy is A.D. Jezzi & Associates, LLC—of which I am the principal—which is a management and technology consultant firm in the paper, nonwoven, and disposable absorbent products industries.

9. I have been awarded four United States patents, and I have had three published United States patent applications related to absorbent materials and laminates. These are summarized in TABLE 1, below.

TABLE 1: My Patents and Patent Application Publications

Patent or Publication No.	Title
4,639,254	Three-dimensional sanitary napkin having absorbent material contoured on the baffle side
5,558,655	Absorbent article with dry surface composite construction
6,818,083	Laminated sheet and method of making same
7,886,411	Apparatus for the uniform distribution of fibers in an air stream
8,122,570	Apparatus and method for dry forming a uniform nonwoven fibrous web
2006/0216473	Methods of manufacturing multilayer elastomeric laminates, and laminates

2007/0003764	Surface treating elastomeric films with coatings to prevent roll blocking
2008/0174128	Mitt-like glove for the collection and disposal of pet excrement

II. COMPENSATION

10. My work on this matter is being billed at \$300/hour for non-testifying work and \$350/hour for testifying work. Also, I am being reimbursed for reasonable expenses I incur in relation to my services. My compensation is not dependent on my testimony or the outcome of any proceeding.

III. LEGAL CONSIDERATIONS

11. I am not an attorney. My understanding of the law is based on information provided by counsel for Attends.

A. Obviousness

12. I understand that a claimed invention is obvious and, therefore, not patentable if the subject matter claimed would have been obvious to a person of ordinary skill in the art at the time that the invention of each of the Diaper Patents (a “POSITA”), which I have been asked to treat as October 27, 2006. I understand that there must be some articulated reasoning with some rational underpinning to support a conclusion of obviousness. I further understand that rationales that may support a conclusion of obviousness include:

- a) simply arranging old elements in a way in which each element performs the same function it was known to perform, and the arrangement yields expected results;

- b) merely substituting one known element for another known element in the field, and the substitution yields no more than a predictable result;
- c) combining elements in a way that was “obvious to try” because of a design need or market pressure, where there was a finite number of identified, predictable solutions;
- d) whether design incentives or other market forces in a field prompted variations in a work that were predictable to a POSITA;
- e) that some teaching, suggestion, or motivation would have led a POSITA to modify the prior art or to combine prior art references to arrive at the claimed invention, among other rationales.

B. Claim Interpretation

13. I understand that a claim term is given the meaning that the term would have to a POSITA at the time of the invention, which generally is the ordinary and customary meaning of the term. I further understand that the ordinary and customary meaning of a term may be evidenced by a variety of sources, including the words of the claims themselves, the specification, the prosecution history, and extrinsic evidence concerning relevant scientific principles, the meaning of technical terms, and the state of the art.

14. I understand that a patent holder is entitled to provide alternate definitions of words in common usage, but if the patent holder uses a term that is in

common usage without providing an alternate definition, then that term should generally be understood as having its common meaning.

C. POSITA

15. I have been asked to provide my opinions regarding the knowledge and understanding of a POSITA at the time of the invention of each of the Diaper Patents.

16. I understand that the factors considered in determining the ordinary level of skill in the art include: (a) the type of problems encountered in the art; (b) prior art solutions to those problems; (c) the rapidity with which innovations are made; (d) the sophistication of the technology; and (e) the education level of active workers in the field.

17. I understand that a POSITA is not a specific real individual, but rather a hypothetical individual having qualities based on the factors above. This hypothetical person has knowledge of all prior art in the relevant field. I also understand that a POSITA is a person of ordinary creativity, not an automaton. Therefore, a POSITA has and applies common sense to modify or combine references in the prior art, and can also find any teaching, suggestion, or motivation, whether to modify or combine, whether explicit or implicit.

18. As of October 27, 2006, it is my opinion that a POSITA as to the Diaper Patents would have had at least a Bachelor of Science degree in chemistry, physics, mechanical engineering, chemical engineering, or process engineering, or a related

degree, and some practical experience in the disposable absorbent article industry, such as about two or three years of experience, although a POSITA having more education may have had less experience and vice versa. A POSITA would have had an understanding of the disposable absorbent article industry in the 1994 to 2006 time frame. That understanding would have included a familiarity with different diaper wing configurations—including both hourglass diapers and diapers with separate wings—nonwoven materials, cloth-like backsheets, and hook-and-loop fastening systems as reflected in Section V.

19. With over 35 years of experience in the disposable absorbent article field, I am well acquainted with the level of ordinary skill required to design disposable absorbent article products. I have direct experience in this field, and I am capable of rendering an informed opinion on the level of ordinary skill in the art as of October 27, 2006.

IV. BASIS FOR OPINIONS

20. My opinions are based on my education, training, and experience as well as items that I reviewed to prepare my opinions, including each of the '788 Patent, the '398 Patent, the '249 Patent, and the '990 Patent, and at least the portions cited herein of the publications listed in the table at the beginning of this declaration. All of my opinions are from the perspective of a POSITA.

V. FIELD OF TECHNOLOGY

A. Diapers

21. Disposable diapers had been widely used for a few decades. EDANA at 12 (“By the late 1980s, disposables accounted for more than 95 percent of diaper changes in Japan, North America, and most European countries.”); *see, e.g.*, Huggies at 1/2 (“Huggies® diapers were first introduced by Kimberly-Clark in 1978.”). Diapers were originally designed primarily for babies but soon were adapted for use with incontinent adults to absorb and contain waste such as urine and feces. *See, e.g.*, Glaug at 1:18-26 (“Disposable absorbent articles, such as infant/child diapers and adult incontinent briefs, are designed to absorb and contain body waste, e.g., urine and/or feces, to prevent such waste from soiling, wetting, or otherwise contaminating clothing or other articles, such as bedding, that come in contact with the wearer.”). In contrast to cloth diapers, disposable diapers were used once and discarded after being soiled. Accordingly, in addition to wearer comfort, cost was an important consideration in diaper design. *See* Glaug at 4:50-54 (identifying the need for a diaper “that is simple in construction, can be manufactured economically and efficiently without wastage, and which provides a good fit, resistance to leakage and wearing comfort”); EDANA at 12 (“Low-cost manufacturing reduced the price premium for disposables relative to cloth diapers and facilitated rapid substitution” and competition yielded “a steady stream of innovations and improvements in

premium diapers, which became better fitting, easier to use, and significantly smaller” while store brands “gradually incorporated many innovations” and “helped hold prices down”).

22. Since the 1960’s, diapers were made of four basic components: 1) a topsheet; 2) an absorbent core; 3) a backsheet; and 4) a fastening mechanism. A topsheet was the layer that defined the diaper’s body-facing surface and typically comprised a permeable nonwoven layer such that waste liquids could be transferred to the absorbent core. *See* Kleinschmidt at 2:6-9 (“topsheet ha[s] a body-facing surface”); Karami ’772 at ¶ [0027] (a “topsheet” is “also referred to as a body-facing sheet, liner or coversheet”). An absorbent core—as its name implies—was the layer that absorbed and stored the liquids, and typically comprised defibrated wood pulp fibers and (since the mid-1980’s) superabsorbent materials to do so. *See* Kleinschmidt at 4:62-66 (describing how absorbent core 28 “absorbed and contained” exudates); Rohrl at ¶ [0001] (“absorptive body layer suitable for long term storage of body fluids which may contain super-absorbing materials”); McCormack at 1:30-41 (“Inside the diaper there is an absorbent core which may be made from natural wood pulp fiber in combination with synthetic fibers and superabsorbents.”); Benning at ¶ [0053] (“absorbent core 28 ... permanently store[s] bodily fluids”); EDANA at 11 (in the 1980s, a “major improvement in diaper design ... involved the use of superabsorbent polymers (SAPs) ... as a partial replacement

for fluff pulp” in absorbent cores). The backsheet was the layer defining the diaper’s outer surface that faced away from a wearer and was liquid impermeable to prevent the migration of liquids that would otherwise soil, for example, the wearer’s garments. *See* Kleinschmidt at 4:62-66 (“The backsheet 26 is generally that portion of the diaper 20 positioned adjacent garment facing surface 45 of the absorbent core 28 which prevents the exudates absorbed and contained therein from soiling articles which may contact the diaper 20.”); ’788 Patent at 1:9-22 and 1:42-45 (the “backsheet [is] on the side of the absorption body directed away from the body” and the “outer surface ... prevent[s] the egress of liquid through the absorbent body to the outside”). The fastening mechanism was used to maintain the diaper in a closed configuration and evolved from adhesive tapes to mechanical fasteners in the 1990’s. *See* Benning at ¶ [0030].

23. Kleinschmidt describes a diaper 20, shown below in annotated versions of Kleinschmidt’s FIGs. 1 and 2, having such a well-known construction. As a POSITA would have understood to be common, diaper 20 has a chassis 22 [red outline] (which the Diaper Patents also refer to as a “main part”) and four side panels 30 [blue] (also referred to as “side parts,” “side flaps,” “ears,” “wings,” and the like) attached to and extending outwardly from the chassis’s longitudinal edges 50. Kleinschmidt at 4:19-24, 6:48-58, and FIGs. 1-2; ’788 Patent at 1:9-30; *see also* Benning at ¶¶ [0002]-[0003]. Chassis 22 includes a liquid-pervious topsheet 24, a

liquid-impervious backsheet 26, and an absorbent core 28 [purple] disposed between the topsheet and backsheet. Kleinschmidt at 4:19-24 and FIG. 2.

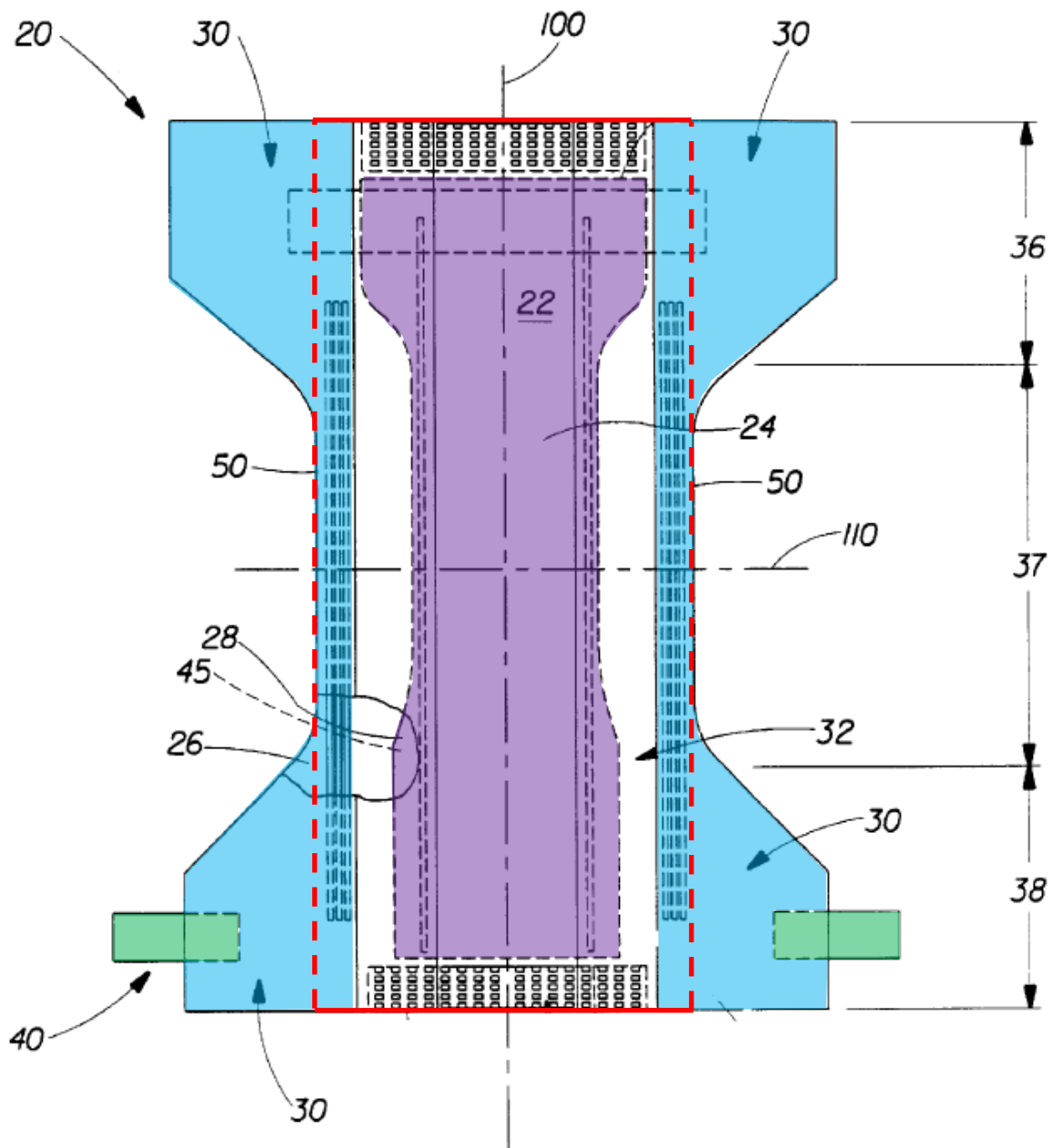
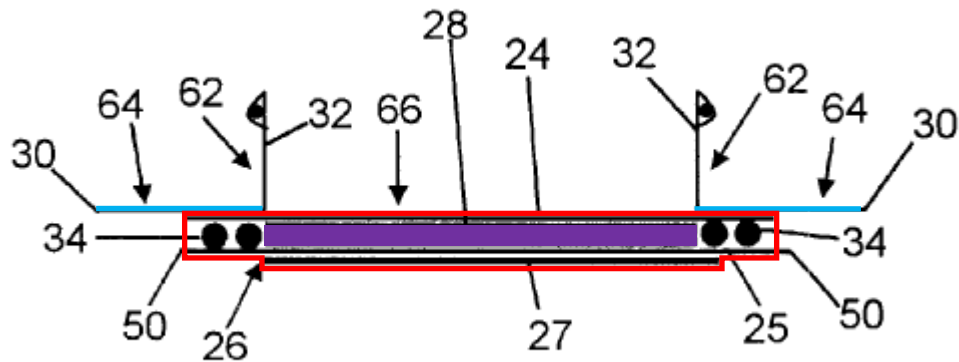


Fig. 1

Annotated Version of Kleinschmidt's FIG. 1
("Annotated1")



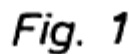
Annotated Version of Kleinschmidt's FIG. 2
("Annotated2")

24. Kleinschmidt's diaper 20 has an "hourglass" configuration that was common. *See* Kleinschmidt at FIG. 1; *see, e.g.*, Horn at ¶ [0033] and FIG. 1 (same-shaped diaper has "an 'hourglass' shape"); Karami '772 at ¶ [0046] and FIG. 6 ("diaper 100 has an 'hourglass' configuration"). The side portions of an "hourglass" diaper 20 have leg cutouts in a crotch region 37 that is disposed between front and rear waist regions 36 and 38 such that the diaper narrows in the crotch region, includes two side panels in the front waist region, and includes two side panels in the rear waist region. Kleinschmidt at 6:48-64 and FIG. 1; *see also* Karami '772 at ¶¶ [0045]-[0046] and FIG. 6. When diaper 20 is worn, side panels 30 of waist regions 36 and 38 "encircle the waist of the wearer" and crotch region 37 is "positioned between the legs of the wearer," with the leg cutouts surrounding the legs. Kleinschmidt at 4:8-18 and FIG. 1. Fasteners 40 [green] on rear side panels 30

maintain diaper 20 in this closed configuration “to hold the diaper 20 on the wearer.” Kleinschmidt at 7:11-25.

25. With the hourglass configuration, side panels 30 can be defined by nonwovens that are “attached to the chassis 22”—where, for each side of the diaper, two side panels 30 are defined by the same nonwoven material—as shown in FIG. 2, or the chassis’ topsheet 24 can be “integrally formed” with the side panels as shown in FIG. 3. Kleinschmidt at 7:64-8:10, 8:40-50, and FIGs. 2-3. While hourglass configurations were common, there were other well-known configurations for diaper wings. For example, as the Diaper Patents acknowledge, it was known to use “discrete” (i.e., separate) side panels attached to the chassis. ’788 Patent at 1:9-22; *see, e.g.*, Rohrl at ¶ [0026] and FIG. 1; Benning at ¶ [0054] and FIG. 1. Rohrl describes one such diaper; as shown below in an annotated version of Rohrl’s FIG. 1, Rohrl’s diaper 2 includes a chassis [red outline] that has an absorbent core 22 [purple] disposed between a backsheet 7 and a topsheet 9 with two front side panels 10 and two rear side panels 12 [blue] attached to the chassis’s edges. Rohrl at ¶¶ [0026]-[0029] and FIGs. 1-2. Additionally, while diapers often had four wings, sometimes they only had two, such as T-shaped diapers in which two rear wings could cooperate to define a belt encircling a user’s waste. *See, e.g.*, Kleinschmidt at 6:59-64 (“side panels 30 [are preferably] disposed in the second waist region 38” but may be “disposed in the first waist region 36 or in both the first waist region 36 and

the second waist region 38”); Karami '341 at ¶¶ [0064] and [0067] and FIGs. 6 and 10-11 (T-shaped diaper 200 has two wings 209, 211 attached to a chassis, which attach to one another to define a belt to which the front of the chassis is subsequently attached).



Annotated Version of Rohrl's FIG. 1
("Annotated3")

26. There were manufacturing and cost benefits associated with using separate side panels as in Rohrl. For example, by omitting the material that extends between front and rear wings in hourglass diapers and not having leg cutouts—which

create scrap—costs could be reduced. *See* Glaug at 4:28-34 and 20:40-51. Separate side panels were also readily made elastic to yield an improved fit and reduce leakage. *See, e.g.*, Cree at 1:14-20, 1:39-42, 8:25-40, FIG. 10. Manufacturers thus began to shift to the separate side panel designs, although hourglass diapers were still used. Nevertheless, the different side panel configurations served the same fundamental purpose (i.e., defining a portion of the diaper that encircles a wearer's waist) and diaper technologies were often applied analogously to them. *See, e.g.*, Karami '772 at ¶ [0025] (new fastening system can be incorporated in “a T-shaped or conventional shaped diaper, a pull-up undergarment, a breathable diaper or any other garment that incorporates a fastening system”).

B. Nonwoven Materials in Diapers

27. Diapers typically had components manufactured from nonwoven materials. *See, e.g.*, Kleinschmidt at 2:19-38 and 5:40-43 (side panels, leg cuffs, topsheet, and backsheet outer cover can comprise a nonwoven); Fries at 4:41-45, 6:33-36, and 16:41-44 (topsheet, backsheet, and side panels can comprise a nonwoven); McCormack at 1:31-35 and 2:25-29 (“Today’s diapers typically include a synthetic fiber nonwoven web as the body side liner material positioned adjacent the baby’s skin” (i.e., a nonwoven topsheet) and film-nonwoven laminates for backsheets). A nonwoven fabric was a web of fibers formed without weaving or knitting the fibers. INDA Glossary at 51-52. To make a nonwoven, fibers were

deposited either randomly or in an oriented manner and thereafter bonded mechanically, thermally, or with a cementing medium. INDA Glossary at 51-52. Different web-forming and bonding processes yielded different types of nonwovens. *See, e.g.*, McCormack at 9:21-26 (describing well-known examples such as “air and wet laying, staple fiber carding and bonding, solution spinning, meltblowing and spunbonding”). Nonwovens that were commonly used in diapers included spunbond nonwovens (in which the web was formed by extruding a polymer into fibers that were laid on a moving screen), carded nonwovens (in which the web was formed by passing fibers over one or more rotating drums having projecting wires or teeth that comb the fibers to facilitate alignment thereof), and composite nonwovens that typically had layers of both spunbond nonwovens and meltblown nonwovens (in which the web was formed by extruding a polymer into fibers that were blown onto a moving screen). *See* INDA Glossary at 15, 47, and 65-66; *see, e.g.*, McCormack at 9:21-28 (“Spunbonded polypropylene webs work particularly well with the present invention.”); Benning at ¶ [0032] (diaper wings are “preferably spunbond materials (S), or spunbond-meltblown materials (SM), or meltblown layers (SMS) coated on both sides with spunbond material layers, or carded non-woven materials”); Karami ’772 at ¶ [0028] (“Examples of suitable top sheet materials include spunbonded or carded nonwoven webs” and can also be “a spunbond-meltblown-spunbond web”). Nonwovens were also sometimes combined with other

materials, such as film-nonwoven laminates for backsheets and three-layer laminates with an elastomeric film disposed between two nonwoven layers to produce elastic wings. *See, e.g.*, McCormack at 2:25-32 and 5:12-16 (backsheets); Cree, 1:39-42, 2:29-45, 8:24-40, FIGs. 1A-1B, 10.

28. Nonwovens were used in diapers because they could be produced inexpensively and could have desirable cloth-like tactile properties, be breathable, and (relevant for topsheets) be liquid permeable. *See, e.g.*, Young at 1:21-27 (“nonwovens to be used in absorbent articles should be soft and non-irritating to the wearer”); Kleinschmidt at 8:11-16 (“barrier leg cuff 32 and side panel 30 may be integrally formed from a single nonwoven ply of material providing the containment capability and softness of a cuff”); Benning at ¶¶ [0032]-[0033] (nonwoven wings “are configured to breathe” and provide “a skin-friendly side section of the hygienic article”); Sun at 8:18-23 (a “spunbond polypropylene nonwoven web” provides a “cloth-like texture”); Karami ’772 at ¶ [0028] (“Nonwoven materials are exemplary because such materials readily allow the passage of liquids” and have “softness for use as a topsheet in an application which will be in contact with human skin”); Huggies at 1/2 (“Nonwoven fabrics combine the softness and stretch of cloth with other almost magical properties.”).

29. One nonwoven parameter that affected its characteristics—such as softness and strength—was basis weight, which was the weight of a unit area of

fabric and was often expressed as grams per square meter (gsm or g/m²) or ounces per square yard (osy). INDA Glossary at 11; *see, e.g.*, Young at 1:21-41 (“[W]hile strength and coverage may be increased by an increase in basis weight, the softness tends to decrease.”); Kleinschmidt at 2:19-32 and 8:11-38 (high basis weight region “provide[s] a side panel delivering the material strength needed for securing a fastening device to the diaper” while the lower basis weight region “deliver[s] a softness that is comfortable to the wearer’s skin”). While diapers used nonwovens having a range of basis weights, common basis weights used for various diaper components were around 15-30 gsm. *See, e.g.*, Young at 1:34-37 (“Nonwovens used in disposable absorbent articles will typically have a basis weight ranging from about 15 gsy to about 30 gsy,” corresponding to 17.9-35.9 gsm). Diapers often used different basis weight nonwovens for different components, with lower basis weight nonwovens being used for components like topsheets, cuffs, and backsheets to promote the softness thereof and higher basis weight nonwovens being used for components like side panels to promote the strength thereof. *See, e.g.*, Young at 1:21-41; Kleinschmidt at 2:19-32 and 8:11-38; Karami ’626 at ¶ [0065] (“slightly higher basis weights of 20-40 gsm (optimally 34 gsm) are preferred for use on the wings” while “relatively lower basis weights of 15-30 gsm (optimally 20 gsm) are preferred for the backsheet”).

C. Cloth-Like Backsheets

30. In early diaper designs, backsheets were “traditionally [] made from plastic films” such as polyethylene films that were liquid impermeable. McCormack at 1:38-41; ’788 Patent at 1:42-45. However, film-only backsheets were “not pleasing to the touch” and while they could be made breathable, breathable films still were “cold and clammy because [they] pass moisture to the outside of the product where it condenses.” McCormack at 1:65-2:2. To address this, backsheets were made by laminating nonwovens to impermeable films, with the film providing liquid impermeability and the nonwoven defining the backsheet’s outer surface to enhance the backsheet’s cloth-like feel. *See* McCormack at 2:25-32 and 5:12-16; Anderson at 1:51-66; Sun at 8:3-28.

31. The first major commercial introduction in this area was by Kimberly-Clark with their Pull-Ups® training pant in 1989 and followed shortly thereafter on their Huggies® Supreme® baby diaper in 1994, whose commercialization I was involved with. *See* Huggies at 1/2 (“While most diapers felt paper-y or plastic-y, new Huggies® Supreme diapers felt like cloth.”). The film during these early launches was a polyethylene non-breathable film in the 0.8 to 1.0 mil thickness range laminated thermally or adhesively to a nonwoven having a basis weight around 15-20 gsm. The nonwoven was usually from one of three basic nonwoven technologies: spunlace, thermal-bonded carding, or spunbond. Around 1996, Kimberly-Clark

introduced breathable films made from polyethylene films loaded with calcium carbonate and stretched to create micropores that imparted breathability in their laminated backsheets. *See McCormack* at 3:66-4:24. Procter & Gamble, which was another major diaper producer, followed a couple years later (around 1998) with their version of this film-nonwoven laminate which was stretched via ring-rolling.

D. Hook-and-Loop Fasteners

32. Originally, the primary fastening mechanism for diapers was adhesive tapes. *Zoia* at 1:16-23. The size of such fasteners varied roughly proportionately with the intended size of the user, with adult diapers (briefs as they were then called) usually having two sets per side, and sometimes three. Adhesive fasteners originally attached to traditional film-only backsheets at any point the user or caretaker wished to adhere the tapes to. However, there were disadvantages with adhesive tapes. The film backsheet had to be relatively thick—close to 2.0 mils—in order to prevent the tapes from tearing the backsheets while in use, which imposed higher costs. For both performance and cost saving reasons, around 1987 the industry introduced reinforcing tape patches to be applied to the front of the diaper as a “target zone” or “landing zone.” These patches were mostly printed films adhesively attached to the backsheet to provide an area of reinforcement as well as a target for the user or caretaker to adhere the fastening tapes to. The film backsheet could thus be reduced in gauge to around 1.0 mil while the gauge of the tape landing zone patch was around

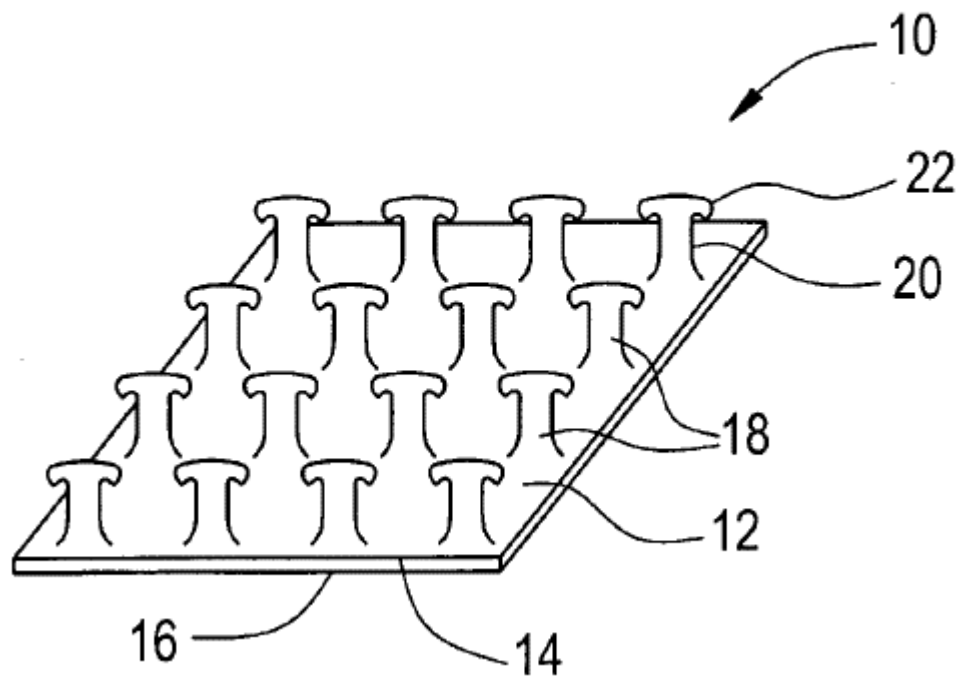
1.25 mils. Despite this, “contaminants such as talcum powder or baby oil either on the pressure-sensitive adhesive or on the portion of the garment to which the pressure-sensitive adhesive is to be adhered” could still “reduce the reliability of [adhesive] fasteners.” Zoia at 1:21-34.

33. Mechanical fasteners—also referred to as hook-and-loop fasteners—later became the industry standard and were not susceptible to contaminant-induced loss of fastener reliability. *See, e.g.*, Zoia at 1:35-40 and 1:58-65; Kleinschmidt at 7:16-20; Horn at ¶¶ [0003]-[0004]; Karami ’626 at ¶ [0003] (the use of hook-and-loop fasteners “has become more or less ubiquitous in the field of disposable absorbent articles”). For example, in 1992 Kimberly-Clark introduced their Depend® Undergarment for adults that included mechanical fasteners and later followed in 1994 with their first baby diaper with mechanical fasteners and elastic ears on their Huggies® Supreme®. Under common vernacular, these fasteners were sometimes referred to as Velcro fasteners after the trade name under which many of such fasteners were sold. *See* Horn at ¶ [0003]; Karami ’772 at ¶ [0002]. However, Velcro® was not the only supplier of mechanical fasteners for diapers; other major suppliers included 3M, Aplix, Koester, and Kuraray.

34. The “hook” or “male” component of mechanical fasteners could be pressed into and thereby releasably engage the “loop” or “female” component to fasten the diaper. Horn at ¶¶ [0003]-[0004]; Karami ’626 at ¶ [0003]. Braverman’s

FIG. 1 and Karami '626's FIG. 12, below, show illustrative hook fasteners. Hooks often had “a stem portion [] attached to the base layer and a head portion []” that was “capable of fixedly engaging into a loop material” and could have geometries such as “a prong, stem, mushroom, J-hook, bi-directional hook, stud(s) protruding at various angle(s), barb, hook, trees,” and the like. Braverman at ¶¶ [0019]-[0020].

FIG. 1



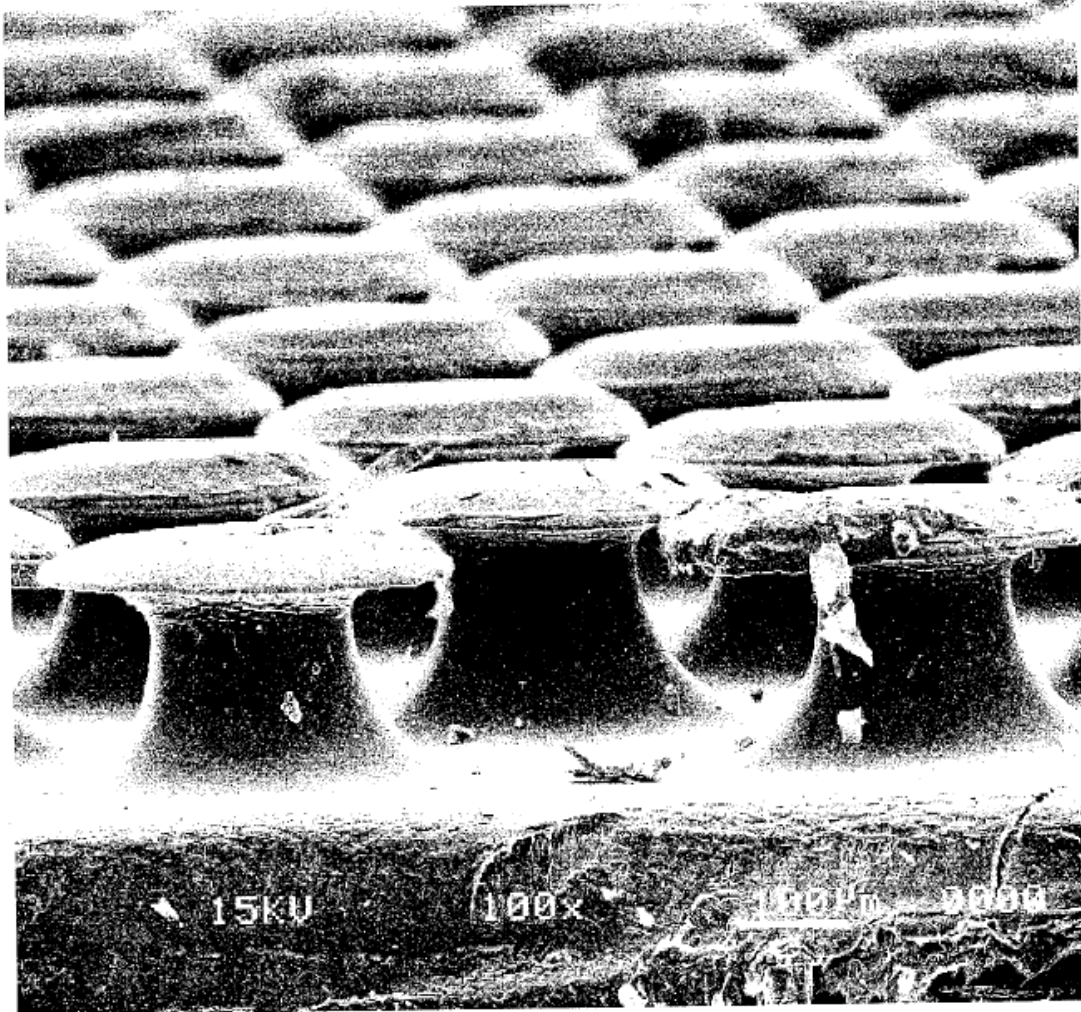


FIG. 12

35. Traditionally, the loop component was a strip of landing zone material attached to the backsheet to which the hook component could be fastened. *See, e.g.,* Miyamoto '499 at ¶¶ [0023] and [0033] and FIG. 3 (hooks 102 engage with landing zone member 94); Karami '626 at ¶ [0003] (“each minihook fastener element [] ha[s] a corresponding miniloop fastener element to engage with—i.e., to serve as a loop-type ‘landing zone’”). However, traditional loop material tended to be more

expensive than other diaper materials like nonwovens, which prompted investigation into more inexpensive hook-and-loop fastening systems. *See* Zoia at 1:35-46; Horn at ¶ [0005] (“Woven and knit materials can be made to provide relatively high reliability due to the ability to make effective loop structures but are relatively high cost materials.”). One development in this area was hook fasteners that could aggressively engage directly with a nonwoven without the need for a traditional loop material landing zone. *See, e.g.*, Braverman at ¶ [0009] (“The hook elements can be capable of engaging the nonwoven material.”); Neugebauer at ¶¶ [0022]-[0023] (“even simple nonwoven materials may be used” as the loop material such that “[t]he frontal tape may be omitted” which “allows a considerable reduction in the total cost of a diaper”). With the widespread use of film-nonwoven laminate backsheets, these hook fasteners could be attached to any portion of the diaper’s outer surface or to the nonwoven side panels thereof for size adjustability. *See, e.g.*, Braverman at ¶ [0051] (“the whole outer surface of the outer cover 302 can be formed of the nonwoven material” such that “the hook material on the hook tab can be attached at various positions on the outer cover ... depending on the shape and size of the wearer”); Neugebauer at ¶¶ [0022]-[0023] (“the diaper-fastening tape according to this aspect of the invention is pressed directly against the nonwoven on the back sheet of the diaper”); Igaue at ¶ [0026] (“The outermost layer of the backsheet 3 may be formed by nonwoven fabrics ... because the hooks of the hook member 16 can

be releasably engaged with such nonwoven fabrics” and “[i]f the front wings 11 are formed by such nonwoven fabrics, the hooks 23 can be releasably engaged also with the front wings 11”). This also allowed the fasteners to be used to maintain the diaper in a folded or rolled configuration after use for disposal thereof.

36. Some diapers that included nonwoven-engageable mechanical fasteners and film-nonwoven backsheets were configured in a way that encouraged fastening to certain portions of the diaper to facilitate proper fit. *See, e.g.*, Damaghi at ¶¶ [0021], [0024], and [0049]-[0051] and FIGs. 3 and 5; Karami '772 at ¶ [0053] and FIG. 8; *see also* O'Connell at 6:17-37 and FIG. 1 (using adhesive tape tabs 70 that can securely attach to outer pieces 82, 84 of landing zone 80 but “do not securely attach to center piece 86” of the landing zone such that “[c]orrect positioning and a proper fit of the diaper is [] improved”). Damaghi's diaper 10, for example, includes a “stay away zone 100 ... on a portion of the outer surface” thereof that comprises a film or is treated such that the hooks of fasteners 50a-50d cannot be attached in the stay away zone. Damaghi at ¶¶ [0050]-[0051] and FIG. 3 (below). Per Damaghi, this still “permitt[ed] a wide range of fastener placement,” such as to wings 31 and 33, “while preventing improper sizing of the diaper.” Damaghi at ¶¶ [0048]-[0052] and FIG. 3.

E. Folded Side Panels

37. During production, diaper side panels were folded to facilitate manufacturing and packaging. Karami '584's process, illustrated in its FIG. 1 (below) shows one example of this. As shown, wings are folded at stations 32, 34 and releasably bonded using "releasable adhesive which serves to prevent the wing from unfolding as it passes through the diaper-making machine." Karami '584 at ¶ [0021]. Folded wings 51 are then "permanently bonded to the topsheet 39 at

stations 53, 55" and later are folded onto and releasably bonded to the chassis.

Karami '584 at ¶ [0022].

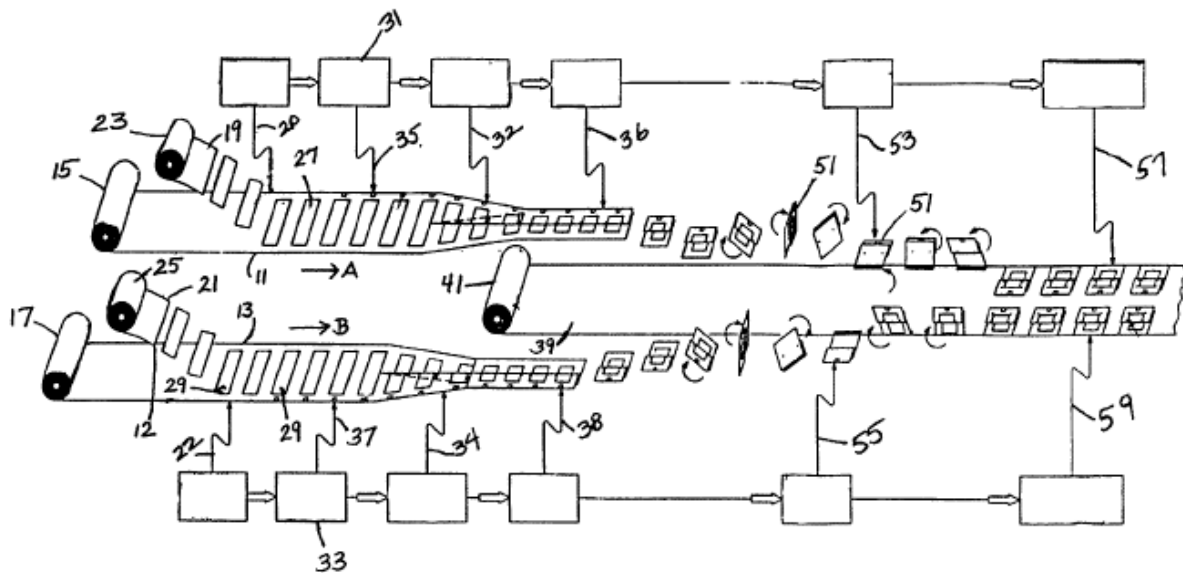
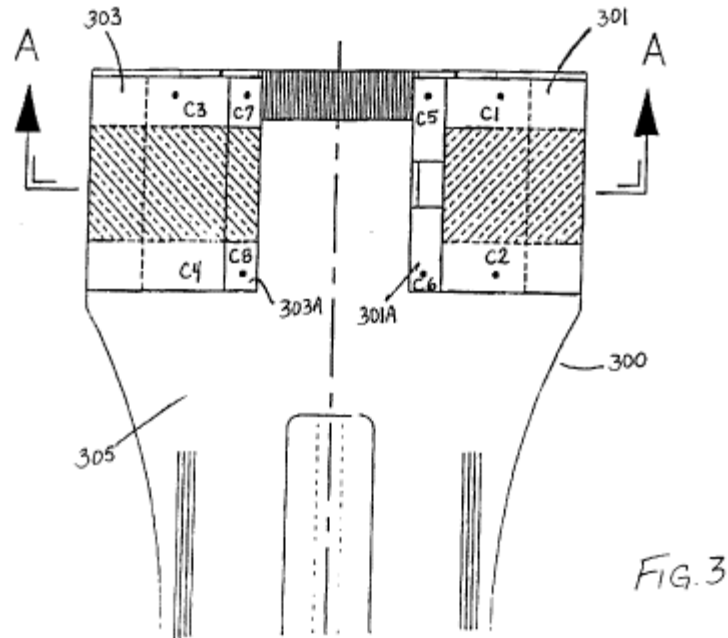


FIG. 1

38. Karami '584's FIG. 3 (below) illustrates a result of such folding, with portions of wings 301, 303 temporarily bonded to one another and to chassis 300 at points C1-C8. Karami '584 at ¶ [0025]. Folding helps achieve "the economic and competitive fabrication of absorbent garments" by preventing the wings from flapping on the manufacturing line. See Karami '584 at ¶¶ [0006]-[0009]. It also reduces the footprint of the diaper to "facilitate[] stacking, packaging and storage of the final product (diaper) prior to shipment for use." Karami '584 at ¶ [0021].



VI. THE DIAPER PATENTS

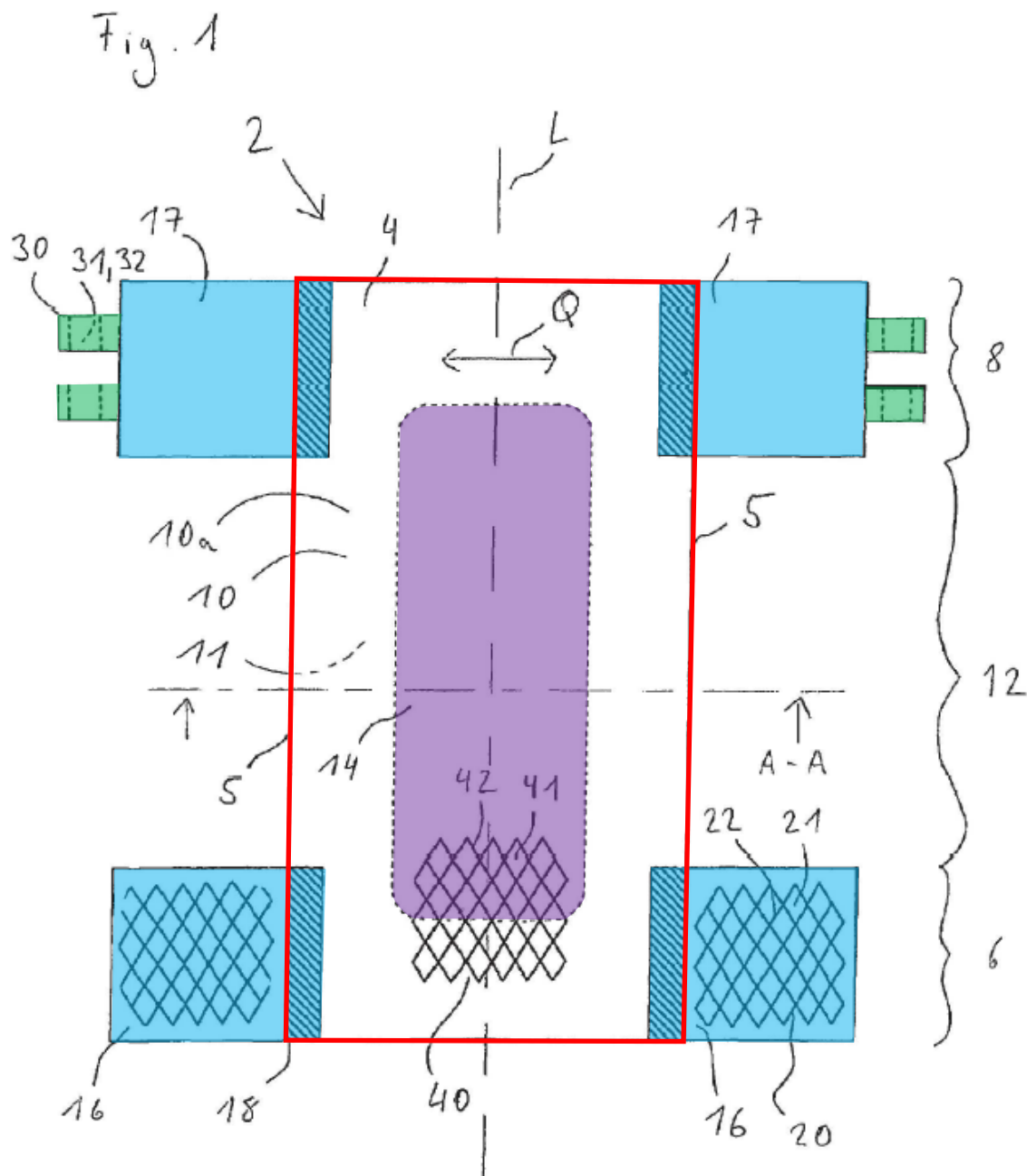
A. Common Specification for Each of the '788 Patent, the '398 Patent, the '249 Patent, and the '990 Patent

39. Each of the '398 Patent, the '249 Patent, and the '990 Patent are continuations of "Ser. No. 12/446,586 filed Apr. 22, 2009 now U.S. Pat. No. 8,152,788" and contain a substantively identical specification as that of the '788 Patent. *See* '398 Patent at 1:4-5; '249 Patent at 1:4-6; '990 Patent at 1:4-7. For brevity, references throughout my declaration are made to the '788 patent, but similarly apply to each of the other Diaper Patents (the '398 Patent, the '249 Patent, and the '990 Patent).

B. Overview of the Diaper Patents

40. The Diaper Patents are each entitled “Absorbent Incontinence Article With Improved Closure System” and directed to a diaper with “mechanical closure means [that] can be secured detachably ... both on the outer face of the [diaper’s] main part [(i.e., chassis)] and also on the outer face of the [diaper’s front] side parts” that are joined to the chassis’ edges. ’788 Patent at Abstract.

41. The Diaper Patents recognize that separate-chassis-and-wings diaper constructions like Rohrl’s (*see* my paragraph 25) were known, acknowledging that the side parts were “preferably made of smooth nonwoven materials” but incorrectly contending that the chassis’ “outer face ... [was] usually constituted by a foil [(i.e., film)] material.” ’788 Patent at 1:9-22 and 1:42-48; Section V.C (film-only backsheets were largely replaced by film-nonwoven laminate backsheets). The Diaper Patents’ diaper 2, annotated below (“Annotated4”), similarly has a separate-chassis-and-wings construction. Diaper 2 comprises a “main part [(or chassis)] 4” [red outline] that includes “an absorbent body 14 [purple] ... disposed between ... a topsheet 11 that is permeable to liquids and a backsheet 10 ... that is impermeable to liquids.” ’788 Patent at 12:9-22 and FIG. 1. Furthermore, diaper 2 has four side parts [blue]: two front side parts 16 and two rear side parts 17 that are attached to and extend outwardly from longitudinal edges 5 of main part 4 “as separate nonwoven material components.” ’788 Patent at 12:23-34.



Annotated Version of the '788 Patent's FIG. 1
("Annotated4")

42. The Diaper Patents also confirm what I discussed in Section V.D: diapers used hook-and-loop fasteners to “detachably connect[their rear wings] either to the outer face of the front area of the main part or to the outer face of the side parts

of the front area” to secure the diaper around a wearer. *See* ’788 Patent at 1:29-41. The Diaper Patents’ diaper 2 similarly includes “closure means 32 [green] having mechanical closure aids 31, in particular, hooks of a hook-and-loop fastener” on its rear side parts 17 such that the rear side parts can be connected to front side parts 16 “to form a hip region.” *See* ’788 Patent at 12:32-42.

43. However, per the Diaper Patents, prior diapers that utilized hook-and-loop fasteners required “a corresponding engagement surface” (e.g., a “textile loop” landing zone) “on the outer face of the front area of the diaper that must be able to engage with the hooks” of the male fastener. ’788 Patent at 1:35-41 and 1:48-51. According to the Diaper Patents, this was disadvantageous because “[s]uch a loop component ... would have to extend along a large part of the front area of the outer face of the diaper to guarantee the large degree of flexibility required for fitting incontinence diapers,” which was “unacceptable for economic reasons” because “textile loop components are a considerable cost factor.” ’788 Patent at 1:42-57.

44. The Diaper Patents’ purported contribution to the art is using mechanical fasteners that can “be secured detachably at least in regions both on the outer face of the main part and also on the outer face of the side parts in the [diaper’s] front area,” where the main part’s and side parts’ outer faces comprise materials that “serve as the engagement surface for the closure means.” ’788 Patent at 1:66-2:13. Per the Diaper Patents, preferred hook-engageable materials for the outer faces of

main part 4 and side parts 16, 17 include “[n]umerous types of nonwovens,” which are “considerably less expensive than textile loop components,” “gentle to the skin,” and give the diaper “a textile-like appearance.” *See* ’788 Patent at 5:16-26, 6:17-35, 12:54-57, and 13:10-12. As was common, main part 4’s backsheet 10 comprises a film 10b laminated to its outer nonwoven 10a such that the backsheet is impermeable, while the side parts 16, 17 need not include a film. *See* ’788 Patent at 5:16-32, 13:10-16, and FIG. 2.

45. Additionally, one of the Diaper Patents’ purported improvements over prior diapers is selecting fastener materials such that “the retaining forces between the mechanical closure means and the outer face of the main part [are] lower than the retaining forces between the mechanical closure means and the outer face of the side parts in the front area.” ’788 Patent at 2:3-6. The Diaper Patents employ nonwoven basis weight variations to do so: “[d]ue to the higher mass per unit area of the nonwoven component for the side parts, the higher closure retaining force is possible because the mechanical closure aids can engage with more fiber material.” ’788 Patent at 7:19-26; *see also* ’788 Patent at 13:34-41 (the higher side part retaining forces are “essentially ensured by the higher mass per unit area of the nonwoven component of the side parts”). In the Diaper Patents’ “especially preferred incontinence diaper 2” (*see* ’788 Patent at 14:39-16:49), for example, the outer nonwoven of each side part 16 was a 30 gsm spunbond nonwoven “obtained

from Corovin GmbH” (*see* ’788 Patent at 14:42-50) and the outer nonwoven of backsheet 10 was a 20 gsm spunbond nonwoven that was also “available from Corovin GmbH” (*see* ’788 Patent at 14:51-62) such that the hook fastener—the “Microplast® 42-288-HX200-PP3” fastener that was “available from G. Binder GmbH” (*see* ’788 Patent at 15:24-29)—exhibited better affinity for the side parts’ nonwoven than for the backsheet’s nonwoven. ’788 Patent at 15:38-44.

46. According to the Diaper Patents, while the hook fasteners can engage with the main part or the side parts, the differential retaining forces “encourage[] the user to fix the closure means ... to the side parts and not to the outer face of the main part.” ’788 Patent at 2:13-24 and 7:26-32. Fastening the closures to the side parts, per the Diaper Patents, “increases the wearing comfort ... because it avoids overlapping of the side parts with the backsheet” to promote breathability and mitigates “the risk of damage to the backsheet.” ’788 Patent at 2:13-26.

C. Interpretation of Certain Terms Used in the Diaper Patents

1. “over-abdomen retaining forces”

47. Claims 2, 3, 12, and 13 recite “over-abdomen retaining forces.” (*See also* ’398 Patent (claims 2-4, 16, 27, and 28); ’249 Patent (claims 2-4, 9, 10, 13-16, 25, 31, 32, 35-37, 39-41, 44, 50, 53, and 54); ’990 Patent (claims 3-6 and 21)). The Diaper Patents state that “[t]o determine the over-abdomen retaining forces, the closure of forces exerted during lateral strain are measured.” ’788 Patent at 2:38-39

(emphasis added). This means that over-abdomen retaining forces are shear strengths between the closure means and the material with which the closure means are engaged. The Diaper Patents describe one way that its shear strengths are measured. *See* '788 Patent at 2:39-4:28 and FIGs. 8 and 9A-9B. Confirming that “over-abdomen retaining forces” are shear strengths, Stupperich uses the same test method to “determin[e] the closing forces under shearing stress.” Stupperich at ¶¶[0035]-[0046] and FIGs. 4 and 5A-5B.

2. “N/25 mm”

48. Claims 2 and 3 express the recited over-abdomen retaining forces in units of “N/25 mm.” (*See also* '398 Patent (claims 2-4, 16, 27, 28, and 30); '249 Patent (claims 3, 4, 14-16, 25, 31, 32, 36, 37, 39, 40, 44, 50, 53, and 54); '990 Patent (claims 3-6 and 21)). These units refer to the force per 25 mm of fastener width, as evidenced by the specification that discloses that a 25-mm wide hook sample is used in the test method described therein unless “no 25-mm wide section ... is available,” in which case “the forces determined are scaled with respect to a 25-mm wide section” using the scaling factor “ $f=25/x$, where x is the width of the specimen measured in mm.” '788 Patent at 3:14-17, 3:44-50, and FIGs. 9A and 9B.

3. “foil”

49. Claims 12-15 recite a “foil” as part of a “nonwoven-foil” laminate. (*See also* '398 Patent (claims 7-10); '249 Patent (claims 17 and 18); '990 Patent (claims

3-6 and 21)). A POSITA would have understood that “foil” means film. This is first confirmed by the specification’s statement that prior diapers’ backsheets were “usually constituted by a foil material,” as backsheets usually comprised a film. *See* ’788 Patent at 1:42-45. Second, the Diaper Patents disclose that the “foil” can comprise the same polymers (e.g., polyethylene and/or polypropylene) (*see* ’788 Patent at 5:38-57) and be manufactured using the same techniques (*see* ’788 Patent at 6:3-16) as typical diaper films. *See also* ’788 Patent at 13:10-16 and FIG. 2 (depicting foil 10b as a thin layer, consistent with it being a film).

4. Mechanical Closure Means/Closure Component Having Mechanical Closure Aids

50. Claim 1 recites a “mechanical closure means having mechanical closure aids” and claims 2, 3, 5, and 21 “closure means.” (*See also* ’398 Patent (claims 1-4, 6, 16, 26, 28, and 30 recite “closure means”); ’249 Patent (claims 1, 3-4, 6, 14-16, 25, 32, 34, 36-37, 39-40, 42, 44, 50, and 54 recite “closure component”)). I understand a patentee can claim certain features in a means-plus-function format, in which the feature will be interpreted as any corresponding structure, or equivalent thereof, that is described in the specification as performing the claimed function. Such an interpretation may be afforded a narrower interpretation than may otherwise be available, as the claimed term is limited to the structures described in the specification. I also understand a claim using the term “means” creates a presumption that such terms will be interpreted in the means-plus-function format.

51. To the extent “mechanical closure means,” “closure means,” and “closure component” are each interpreted as means plus function, this term will include the described structures that perform the claimed function of the “mechanical closure means”/“closure component” and any equivalents. Such an interpretation is limited to the structures described in each Diaper Patents’ specification. The specification describes connecting side parts to the main parts via “closure means 32 having mechanical closure aids 31, in particular, hooks of a hook-and-loop fastener” and that “adhesive closure aids, such as pressure-sensitive adhesive regions” could be provided in addition to the mechanical closure aids. ’788 Patent at 4:29-62, 12:33-42. A POSITA would have understood that closure means/components would have included a hook-and-loop type fastener and, optionally, may also include adhesive regions. ’788 Patent at 4:29-62, 12:33-42, and 15:24-37.

52. However, any such interpretation is not relevant to my opinions, below, as the structures mapped in the cited references include the same structures—hook-and-loop fasteners (Section VII.B-C)—that are disclosed as in each Diaper Patents’ specification. Accordingly, my opinions are applicable under either a standard interpretation or a means-plus-function interpretation.

5. *Reinforcing Means/Material*

53. As explained in my paragraph 50, I understand a patentee may claim certain features as means-plus-function and such features will be interpreted as including the corresponding structures, as described in the specification, that perform the claimed function. Claim 21 recites a “reinforcing means” which, if interpreted as means plus function, will include the described structures that perform its claimed function. *See also* ’249 Patent (claim 28 recites “reinforcing material”).

54. The specification describes “a reinforcing means 7” that provides a reinforce connection between side section 17 and the chassis (e.g., “tear protection for the side section 17, in particular, on application of a tensile force directed obliquely to the transverse direction ... on closure of the diaper”). ’788 Patent at 14:22-27. Structurally, the reinforcing means may include an additional reinforcing material—such as a nonwoven, a foil (film), or textile material—that is applied to the side part or, alternatively, the reinforcing means may be constructed from the side part itself, by folding the side part into a Z-configuration. ’788 Patent at 11:10-22; 14:27-38. A POSITA would have understood the claimed reinforcing means as including a reinforcing material, such as strip- or ribbon-shaped sections of material (e.g., a nonwoven or film), that is the same as, or separate from, the side part’s nonwoven.

55. However, any such interpretation is not relevant to my opinions, below, as the structures of the cited references include the same structures—strip of textile material (Section VII.I)—as are disclosed in each Diaper Patents’ specification. Accordingly, my opinions are applicable under either a standard interpretation or a means-plus-function interpretation.

D. The Diaper Patents’ Test Method

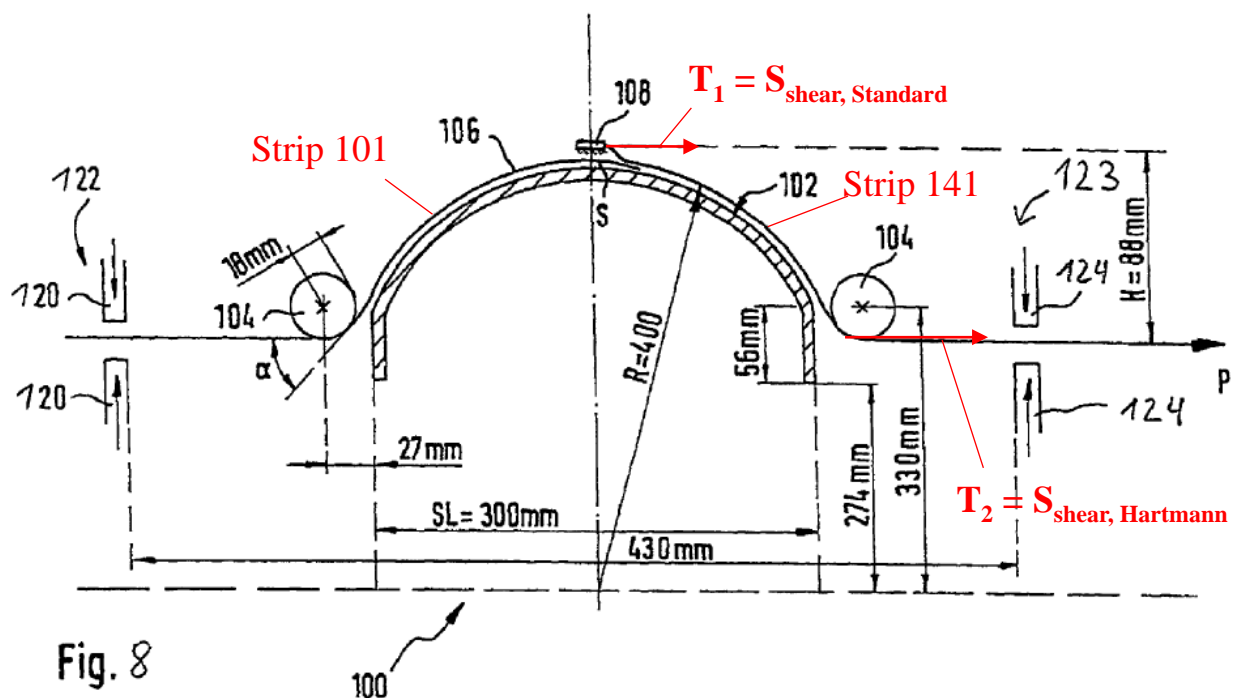
56. Two common fastening strength metrics were peel strength and shear strength, where peel strength reflected a fastener’s ability to resist separation upon “application of a peeling force in a direction generally perpendicular or normal to the plane defined by the connected surfaces of the hook and loop components” and shear strength reflected a fastener’s ability to resist separation upon “application of a shear force or stress, which is applied in a plane parallel to or defined by the connected surfaces of the hook and loop components.” Braverman at ¶ [0003].

57. The Diaper Patents describe the “over-abdomen retaining forces” of their fasteners, which are the measured “closure of forces exerted during lateral strain,” meaning that they are shear strengths. *See* ’788 Patent at 2:7-8 and 2:30-39. The number of companies manufacturing hook closure mechanisms was fairly consolidated, with essentially five companies (3M, Velcro, Koester, Aplix, and Kuraray) supplying these materials globally, although there were many companies in China that supplied their domestic markets. These companies employed similar

testing methodologies for measuring fastener shear strengths, which typically were modified versions of the ASTM D5169 test method. *See, e.g.*, Miller at 10:48-11:9; Braverman at ¶ [0037]; ASTM D5169 at 6.2 and 10.6. In Miller, for example, to test shear strength a nonwoven sample is engaged with a hook sample such that there is a 51 mm length by 25 mm width overlap and a 5 kg roller is rolled over the samples five times back and forth (ten times total) to achieve secure engagement. Miller at 10:56-65. The shear forces are then measured via an Instron Model 1122 tensile tester so that the line along which the shear is to be tested (i.e., the line along which the loop and fastener are pulled apart) is parallel to and centered along the direction of movement of the tester's jaws. Miller at 10:47-51, 10:65-11:9. In other words, the shear forces are measured in the plane of the sample.

58. The Diaper Patents disclose “[a] test method for determining the closure forces during lateral strain” that differs from the standard test method that was used. ’788 Patent at 2:39-4:28 and FIGs. 8 and 9A-9B. One difference is that in the Diaper Patents’ test method “the closure system to be tested with a loop component and a closure means having mechanical closure aids adhering thereto is placed on a curved surface, which is intended to simulate the curvature of the abdomen region of a user.” ’788 Patent at 2:45-50. The Diaper Patents’ FIG. 8 (below), illustrates this curved surface. As shown, hook closure 108 is engaged with nonwoven loop component 106 on “the center of the apex 5 of the curved surface

102.” ’788 Patent at 4:9-14 and FIG. 8. Loop component 106 and hook closure 108 are connected to clamps 120, 124 via adhesive strips 101, 141 that extend along curved surface 102, with the loop component sandwiched between strips 101, and strips 141 bonded to the hook closure. *See* ’788 Patent at 2:50-58, 3:4-23, and FIGs. 8 and 9A-9B. Strips 101, 141, after leaving curved surface 102 at an angle α of 60° , are passed around redirection rollers 104 such that they are redirected to jaws 120, 124 in a horizontal direction. ’788 Patent at 4:2-9 and FIG. 8. To test shear strength, strips 101, 141 are held by clamps 120, 124 and clamp 124 is moved in direction P; the shear strength is measured as “the tensile force between the clamps” required to separate the fastener and loop. ’788 Patent at 4:14-28.



Annotated Version of the '788 Patent's FIG. 8
("Annotated5")

59. As annotated above in FIG. 8, the tensile force measured as the shear strength in the Diaper Patents' test method (T_2) is that in strip 141 after passing around roller 104, rather than the tensile force directly at fastener 108 (T_1) as would have been measured in a standard test method. Accordingly, due at least in part to friction between strip 141 and curved surface 102, a shear strength between fastening components measured using the Diaper Patents' test method is inflated, relative to if measured using an otherwise similar standard test method in which the pulling is performed in the plane of the fastening components.

60. Other aspects of the test method may also affect the measured shear strength differently as compared to standardized test methods (e.g., ASTM D5169 test method). One such aspect is the area of engagement between the hook sample and the loop sample (e.g., the nonwoven). Shear strength is approximately proportional to engagement area, with larger areas yielding larger shear strengths. In the Diaper Patents' test method, the sample size for the loop material (or female engagement surface) is 50 mm wide by 300 mm long, which is larger than the sample size for the hook material that has a 25 mm width—unless fasteners that wide are unavailable—and a length that is “the same length as is to be used for the incontinence diaper” as shown below in the '788 Patent's FIG. 9A. '788 Patent at 3:4-23, 3:44-50, and FIG. 9A. The dimensions of the smaller hook sample 108 thus define the engagement area.

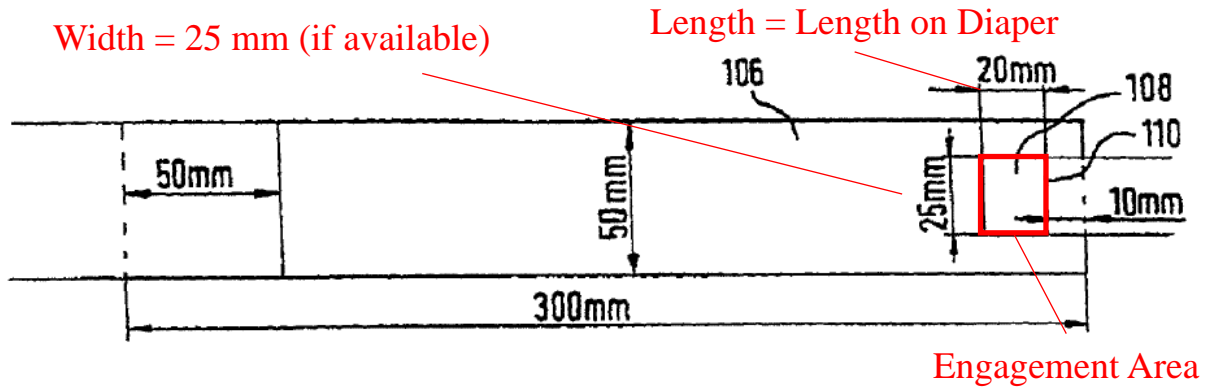


Fig. 9a

Annotated Version of the '788 Patent's FIG. 9A
("Annotated6")

61. While the length of fastener engagement in the Diaper Patents' example is 20 mm, in its test method the fastener length—and thus area of engagement—depends on the diaper fastener tested and is not fixed. *See* '788 Patent at 3:14-23 ("in the example 20 mm"); *compare with* Miller at 10:56-63 (using fixed length). At the same time, the Diaper Patents normalize the measured shear strength to a 25 mm width regardless of the actual width used on the diaper. *See* '788 Patent at 3:44-50 ("If no 25-mm wide section of the closure means 108 having mechanical closure aids is available, a correspondingly narrower section is used" and "the forces determined are scaled with respect to a 25-mm wide section" by multiplying the measured forces "by a factor f resulting from $f=25/x$, where x is the width of the specimen measured in mm"). This means that the Diaper Patents' test method provides width-normalized shear strengths that depend on (1) the type of hook and loop components and (2) the length of the fastener, rather than absolute shear

strengths. For example, if the fastening systems of two diapers having the same hook and nonwoven loop components are tested but one diaper has a longer hook fastener (e.g., because it is intended to be used for a larger wearer), the diaper with the longer hook fastener will have a larger width-normalized shear strength under the Diaper Patents' test method despite using the same hook and loop component because it has a larger engagement area. Accordingly, a fastener's length—but not its width—will impact the width-normalized (N/25 mm) values in the Diaper Patents' method.

VII. ANALYSIS OF PRIOR ART TO THE DIAPER PATENTS

A. Benning

62. As shown below, Benning discloses a diaper having the well-known configuration described in the Diaper Patents, which can be “specifically for incontinent adults.” *See* '788 Patent at 1:9-22; Benning at ¶¶ [0002], [0053]-[0054] and FIGs. 4-5. Benning's diaper comprises (1) a “main body portion” or “chassis” 20 [red outline] that includes “a front region 22, a back region 24, and a crotch region 26 between them” and (2) four “material sections” or “side flaps” 34 [blue] (commonly referred to as “ears,” “wings,” “side parts,” and the like) that are attached to the edges of the chassis—two at the front region and two at the back region—but are not directly connected to one another. Benning at ¶¶ [0029] and [0053]-[0054] and FIG. 4. When unfolded, side flaps 34 extend outwardly from chassis 20

in transverse direction 38 such that they can “encircle[e] the [wearer’s] hips” while crotch region 26 “is positioned between the [wearer’s] legs.” Benning at ¶¶ [0053]-[0055] and FIG. 4. Each of the two side flaps 34 attached to back region 24 includes closures 42 [green] that can be releasably secured to outside 46 of chassis 20’s front region 22 to maintain the diaper in the closed position. Benning at ¶¶ [0030] and [0055] and FIG. 4. Closures 42 can include mechanical fasteners—which a POSITA would have understood are “hook” fasteners—or adhesive tapes 44. Benning at ¶¶ [0030] and [0055]; Horn at ¶ [0002] (“mechanical fasteners [are] often referred to as ‘hook and loop’ fasteners”); Zoia at 5:48-58 (hook-type fasteners “mechanically engage”); Karami ’626 at ¶ [0068] (same). A POSITA would have seen Benning’s hook fasteners as advantageous over his adhesive tapes, given that adhesive tapes were known to be more susceptible to reliability-reducing contamination. *See* my paragraphs 32 and 33.

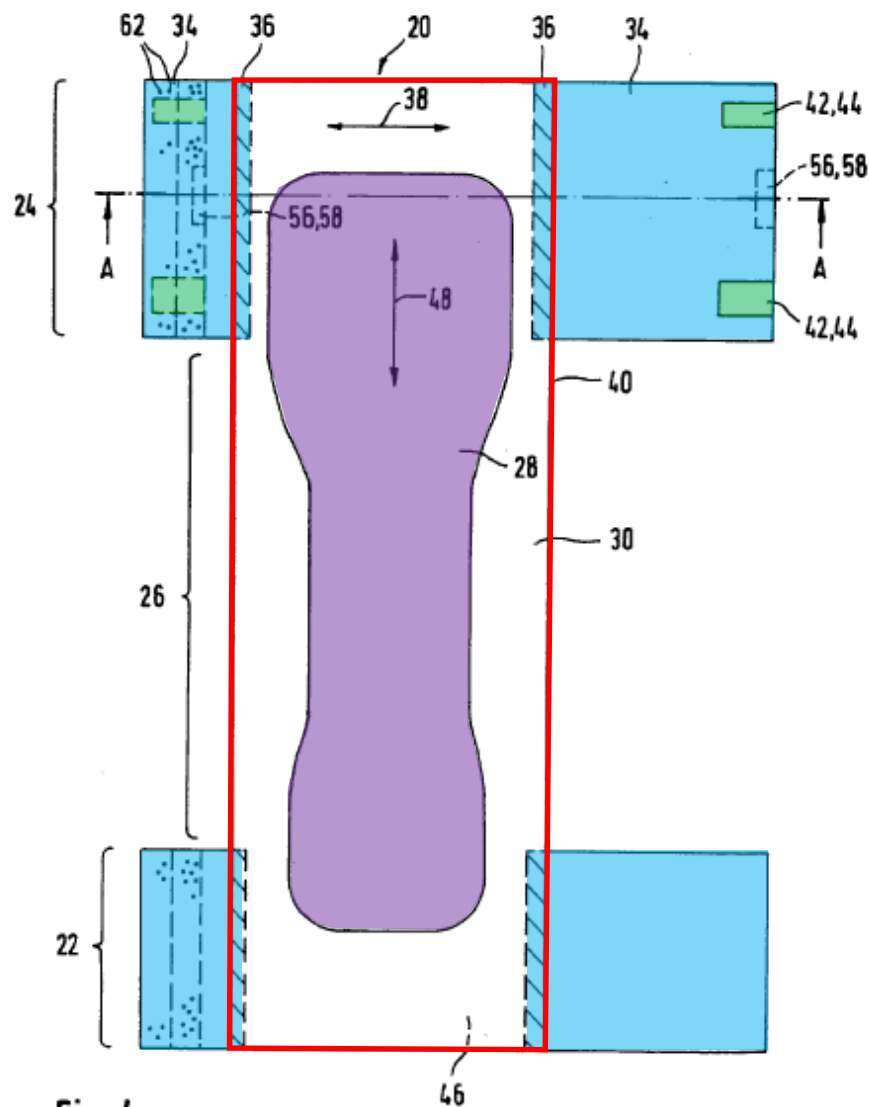


Fig. 4

Annotated Version of Benning's FIG. 4
("Annotated7")

63. Chassis 20 includes a “fluid-impermeable [(i.e., liquid-impermeable)] underlayer 30” (commonly referred to as a backsheet), a fluid-permeable topsheet 32, and an absorbent core 28 [purple] disposed therebetween that can “receive and permanently store bodily fluids.” Benning at ¶¶ [0003], [0033], and [0053] and FIGs. 4-5. The width of absorbent core 28 is smaller than that of

backsheet 30. *See* Benning at FIGs. 4 and 5. A POSITA would have understood that topsheet 32 faces a wearer when the diaper is worn such that bodily fluids from the wearer can pass through the fluid-permeable topsheet to absorbent core 28. *See* Benning at ¶ [0053] and FIGs. 4-5. Fluid-impermeable backsheet 30, by contrast, faces away from the wearer to prevent the bodily fluids from soiling the wearer's garments. *See* Benning at ¶ [0053] and FIGs. 4-5.

64. Side flaps 34 can comprise nonwoven material, such as a spunbond nonwoven, that is breathable such that the flaps are air- and water vapor-permeable. Benning at ¶ [0032]. Having nonwovens that allow the transmission of air and water vapor, a POSITA would have understood that side flaps 34 can be liquid permeable as well. *See, e.g.*, Karami '772 at ¶ [0028] ("Nonwoven materials ... readily allow the passage of liquids."). A basis weight of side flaps 34 can be 10-150 g/m², "and specifically [] 25-50 g/m²." Benning at ¶ [0032].

65. To facilitate manufacturing and application of the diaper to a wearer, side flaps 34 "are folded over themselves at least along one fold line running in the longitudinal direction." Benning at ¶¶ [0006]-[0007] and [0055]-[0060] and FIGs. 4-6 and 8. For example, each side flap 34 can be "folded over itself in a gate-fold format along three fold lines 50, 52, 54 extending in the lengthwise direction" such that partial sections 60 of the side flap lie against one another. Benning at ¶¶ [0020] and [0056]-[0060] and FIGs. 5-6 and 8. To maintain the folded

configuration before use, partial sections 60 are “releasably attached at affixation point[s] or areas” to each other, such as through “affixation points 62 generated by ultrasonic welding.” Benning at ¶¶ [0006]-[0008] and [0058] and FIGs. 4 and 7. Such folding and affixation facilitates manufacturing by preventing the side flaps from fluttering “in the high-speed manufacturing machine,” which is consistent with other known manufacturing techniques. Benning at ¶ [0007]; *see, e.g.*, Karami ’584 at ¶¶ [0006]-[0009] and [0021] and FIGs. 1 and 3-6 (similarly folding and temporarily bonding wings as part of its “efficient and commercially viable method of manufacturing absorbent articles”). The folding and fixation also “simplifie[s]” the “process of feeding the section under [a side-lying] patient” and is carried out to permit the flaps to be unfolded with a single pull. Benning at ¶¶ [0007], [0019]-[0021], [0025], [0034], and [0058].

B. Karami ’772

66. Karami ’772 describes absorbent articles such as “T-shaped or conventional shaped diaper[s], [] pull-up undergarment[s], [] breathable diaper[s] or any other garment that incorporates a fastening system” that “does not include a loop fastening system.” *See, e.g.*, Karami ’772 at ¶ [0025], FIGs. 1, 6, and 8. Per Karami ’772, prior articles using minihook fasteners to secure the article around a wearer needed “a corresponding miniloop fastener element . . . to serve as a loop-type ‘landing zone’” with which the minihook fastener could engage. Karami ’772

at ¶ [0002]. The requirement for a “landing zone” imposed constraints on where the minihook fasteners could be fastened on the article and thus on size adaptability. *See* Karami ’772 at ¶¶ [0003]-[0005] (the minihook fastener not being “capable of engaging anywhere along a facing surface of another article or article portion” is a “disadvantage”). For example, while some “proposed that one entire surface of an article be constituted of a miniloop fastener element in order to provide the user with total flexibility and choice,” such increased flexibility was outweighed by “the added material and manufacturing costs.” Karami ’772 at ¶¶ [0003] and [0005].

67. Karami ’772 sought to address these perceived shortcomings by incorporating a nonwoven to define an outer surface of the diaper such that the surface of the nonwoven may releasably engage with hook-type fasteners, thereby obviating the need for an additional miniloop fastener element for higher peel and shear strength. Karami ’772 at ¶¶ [0010]-[0012], [0025], and [0036]. Karami ’772 subjects the nonwoven to a water jet treatment and/or aperturing to increase engagement between the nonwoven and his fasteners in the wings 40 and in portions of the backsheet 32. In the water jet treatment, “at least one surface of the bonded nonwoven is subjected to at least one row of water jets while an opposite surface of the bonded nonwoven is being sucked by a vacuum to a forming surface or screen” to create “a repeating pattern of three-dimensional relief structures.” Karami ’772 at ¶ [0036] and FIG. 4. A POSITA would have understood that this water jet

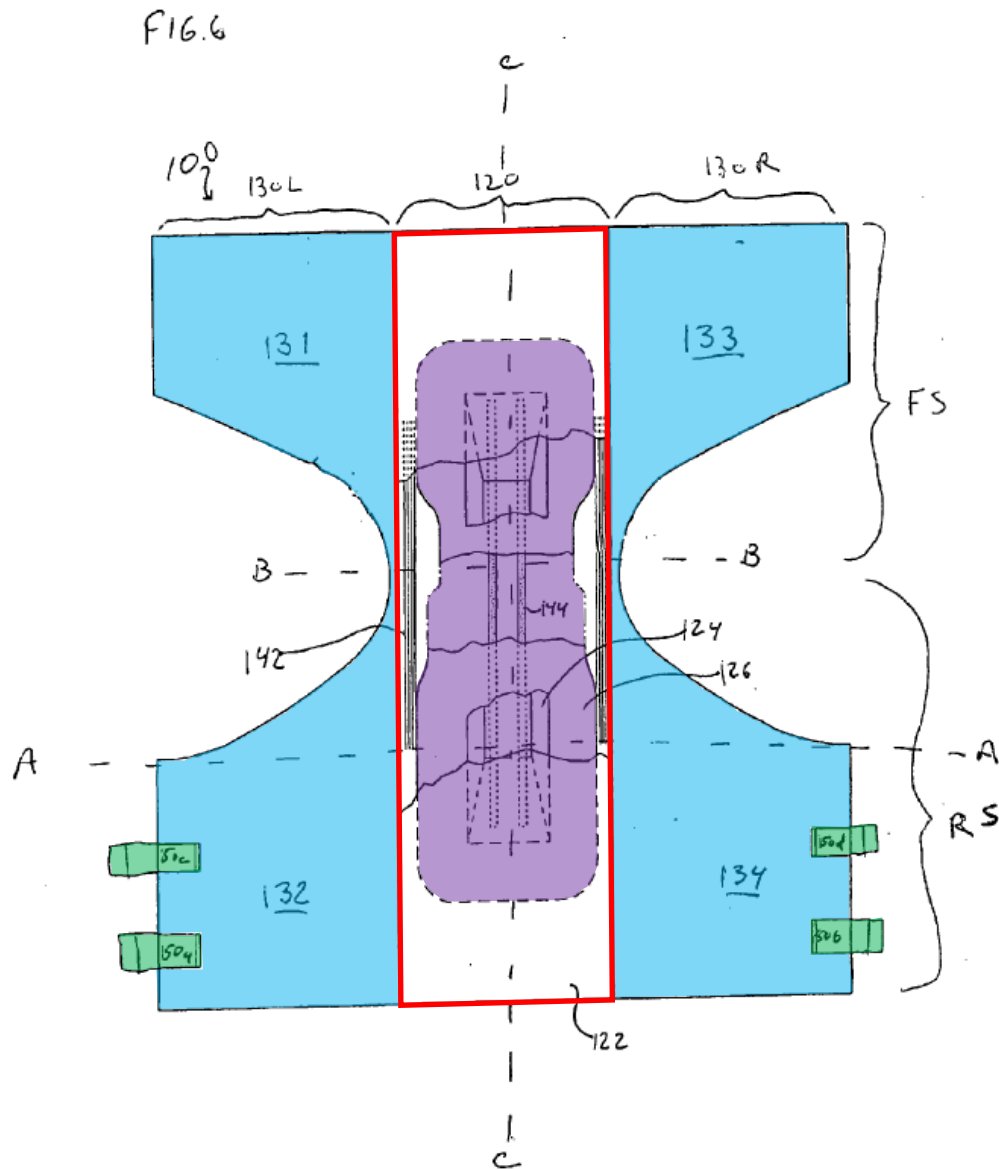
treatment fibrillates the nonwoven fibers and thereby increases the surface area thereof available for engagement with hooks to increase retaining forces. In the aperturing treatment, the nonwoven is passed between two rolls—one having pins and the other having holes—such that “perforations are formed without removing any material from the nonwoven web.” Karami ’772 at ¶ [0037]. These treatments “provide[] a softer, bulkier and more flexible nonwoven” that accordingly “has better affinity to engage hook-type fasteners as compared to [a] bonded nonwoven” not subjected to the treatments. Karami ’772 at ¶¶ [0036] and [0037].

68. Karami ’772 tested the peel and shear forces between various fasteners and treated and untreated nonwovens “using a modified version of the ASTM standardized testing procedures” that is left largely unexplained. Karami ’772 at ¶ [0041] and TABLE 1. Nevertheless, Karami ’772’s testing illustrates the improved hook affinity resulting from its treatments. Karami ’772 at TABLE 1. Furthermore, as these tests confirmed, there still were retaining forces between the hooks and untreated nonwovens. *See* Karami ’772 at ¶¶ [0036]-[0037] (treatments yielded “better affinity”) [0053] (nonwoven without treatment “will have diminished affinity”), and TABLE 1 (showing there are still shear forces with untreated nonwovens).

69. These retaining forces between the hook fastener and the untreated nonwoven were high enough to hold the diaper on a wearer during use.

70. This understanding is confirmed by Karami '626 which teaches a nonwoven specifically designed for engaging with hooks of a hook-type fastener when “use[d] by both large- and small-waisted persons.” Karami '626 at ¶¶ [0007]-[0009] and [0039]. Karami '626's described nonwoven is preferably a spunbond having a basis weight of 13-50 grams per square meter (gsm), which is within the range contemplated by Karami '772's untreated nonwoven. *See* Karami '772 at ¶¶ [0028], [0030], [0041] (suitable material includes spunbonded or carded nonwoven webs preferably having a weight between 5-45 gsm, with examples of 20 and 33.9 gsm). As a specific example, Karami '772's nonwoven (FABRILEX 307 or 305) and fastener (Binder 25445 hook fastener) may be the same as that of Karami '626. *See* Karami '626 at ¶¶ [0039] (“A Suitable composite is available from Treadgar [sic, Tredegar] Company under the designation FABRIFLEX 307.”) and [0060] (“preferred fastener element is available from Binder Macroplast LP of Germany under the trade designation #42-288-HX-200-PP3”); '788 Patent at 15:25-28 (confirming Binder 25445 hook fastener is the same as 42-288-HX-200-PP3). Thus, as Karami '772's untreated nonwoven may be the same nonwoven and hook fastener suitable to secure an absorbent article to a wearer—as explained by Karami '626—a POSITA would have recognized the retaining forces between Karami '772's fastener and untreated nonwoven were suitable to secure an absorbent article to a wearer when the article is in use.

71. FIG. 6—annotated below—depicts one of Karami '772's diapers 100 that has a conventional “hourglass” configuration and incorporates a treated nonwoven for fastening. Karami '772 at ¶¶ [0044]-[0046]. A POSITA would have understood that diaper 100 can be an article for an infant or an adult. *See* Karami '772 at ¶ [0026] (“As used herein, the term ‘diaper’ generally refers to an absorbent article worn about the torso of an infant or incontinent person;” a POSITA would have understood that incontinence products are those intended for adults); *see also* Karami '772 at ¶ [0030] (“the size and absorbent capacity of [T-shaped diaper 10's] absorbent core 34 may be varied to accommodate wearers ranging from infants through adults”).



Annotated Version of Karami '772's FIG. 6
("Annotated8")

72. In FIG. 6 above, diaper 100 includes a backsheet 130 that defines four wings [blue]: wings 131 and 133 at the diaper's front section and wings 132 and 134 at the diaper's rear section Karami '772 at ¶¶ [0046]-[0047] and FIG. 6. Backsheet 130 comprises a nonwoven that defines its entire outer surface, has basis

weight of 5-45 gsm, and can be laminated to a polypropylene or polyethylene film. Karami '772 at ¶ [0052] (“the backsheet [of diaper 100] may be formed of the above-identified nonwoven layered with a polypropylene or polyethylene film”); *see also* Karami '772 at ¶ [0048] and FIGs. 6 and 8 (fasteners 150a-150d engage with the nonwoven of wings 131 and 133 that are defined by the backsheet, meaning the nonwoven is on the outer surface).

73. Additionally, diaper 100 comprises a containment assembly 120 [red outline] including a topsheet 122 and absorbent core 126 [purple] along the diaper's longitudinal centerline C such that the core is disposed between the topsheet and the backsheet. *See* Karami '772 at Abstract, ¶¶ [0046]-[0047], and FIG. 6 (cut-out view showing the core above the backsheet and underneath the topsheet, consistent with a POSITA's understanding of a conventional diaper construction and Karami '772's Abstract). Absorbent core 126 is narrower than backsheet 130 and the entire containment assembly 120. Karami '772 at ¶ [0047] and FIG. 6 (the containment assembly spans a greater width than the core). As a POSITA would have understood, topsheet 122 is liquid-permeable and backsheet 130 is liquid-impermeable and, when diaper 100 is worn, the topsheet faces the wearer such that liquids can reach absorbent core 126 and the backsheet faces away from the wearer to prevent liquid egress. *See* Karami '772 at ¶¶ [0027]-[0028], [0031], and [0052] (describing, with respect to FIG. 2, how a “topsheet” is “also referred to as a body-

facing sheet” and “may be made of any suitable relatively liquid-pervious material” and a “backsheet” is “also referred to as a garment-facing sheet” and “is made of a liquid and/or vapor-impervious material”) and [0048] (fasteners engage with the “outer surface of the wings 131 and 133,” meaning the backsheet defines the outer surface).

74. Rear wings 132 and 134 include hook-type fasteners 150a-150d [green]—which are mechanical fasteners—to secure diaper 100 around a wearer. Karami '772 at ¶¶ [0047]-[0048] and FIG. 6. Fasteners 150a-150d can engage with the outer surface of backsheet 130, which comprises a nonwoven defining its entire outer surface (that does not include other fastening materials beyond the nonwoven) as explained in my paragraph 72. Karami '772 at ¶¶ [0047]-[0048]. The fastening is “not restricted to specific landing zones,” meaning that mechanical fasteners 150a-150d are capable of releasably engaging the outer nonwoven of backsheet 130 either in front wings 131 and 133 or in the central, main portion thereof underlying containment assembly 120. *See* Karami '772 at ¶ [0048] and FIG. 6. This allows for size adjustability: when diaper 100 is placed on a wearer, fastener placement will depend on the wearer’s size, with smaller wearers tending to place fasteners 150a-150d closer to the central portion of backsheet 130 such that the resulting waist opening is smaller and larger wearers tending to place the fasteners closer to the free ends of front wings 131 and 133 such that the resulting waist opening is larger. *See*

Karami '772 at FIGs. 6, 8 (FIG. 8 shows fasteners 150a-150d attached to wings 131 and 133). This is analogous to the sizing of Karami '772's T-shaped diaper, where "[t]he degree of overlap in the connection between the wings 40 (to form the belt 44) will vary with the waist size of the wearer." Karami '772 at ¶¶ [0042].

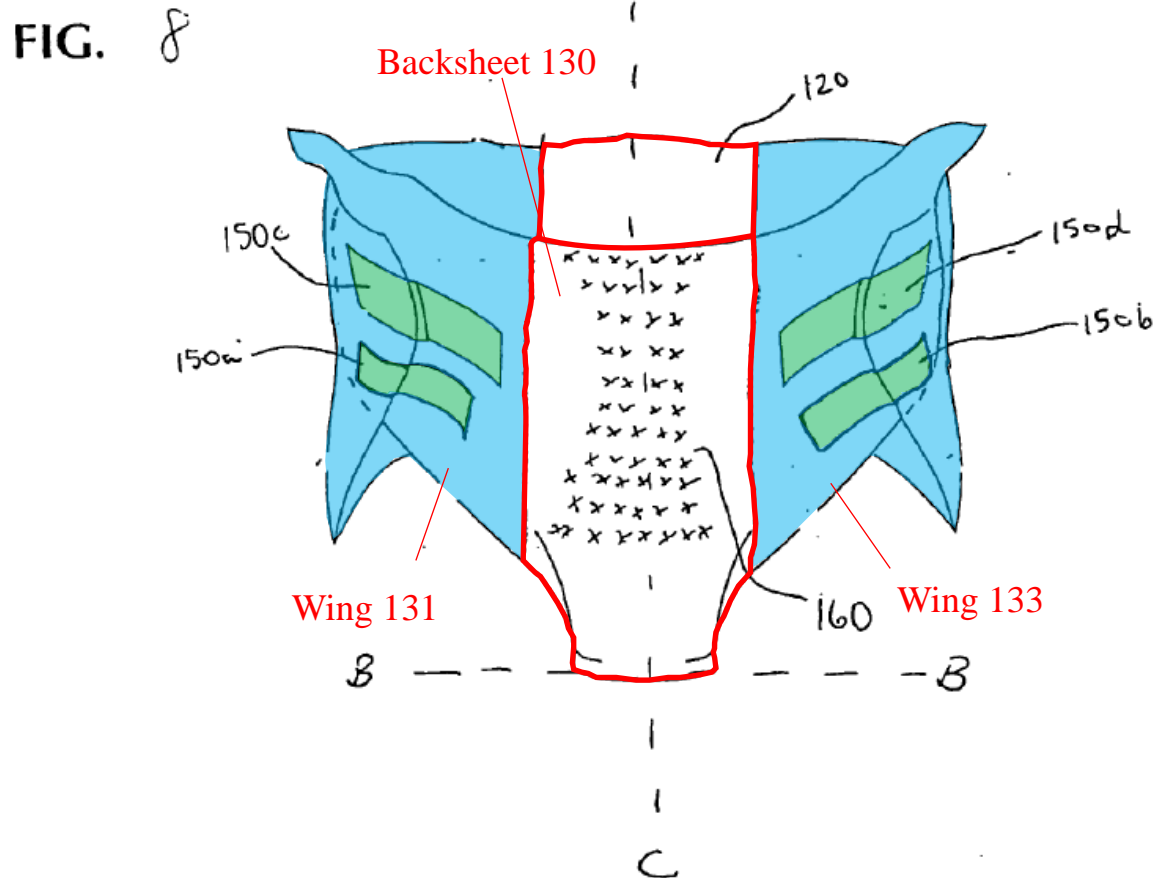
75. At least a portion of the nonwoven of each of front wings 131 and 133 is "water jet treated and/or apertured" such that the retaining forces between fasteners 150a-150d and the wings is "significantly higher." Karami '772 at ¶ [0048]. As shown in FIG. 8 (below), a portion of backsheet 130's nonwoven that underlies containment assembly 120 can remain untreated such that it has "diminished affinity to hook-type fasteners in relation to the remainder of the front waist portion" to define a stay-away zone 160. Karami '772 at ¶¶ [0047]-[0048] (describing treatment of wings 131 and 133 of backsheet 130) and [0053] and FIG. 8¹ (confirming that the entire front waist portion of the backsheet can be treated

¹ A POSITA would have understood that the FIG. 8 diaper is, at most, a variation of the FIG. 6 diaper because they are described with the same reference numerals (*see, e.g.,* Karami '772 at ¶¶ [0046] and [0053] ("as shown in FIG. 8, the diaper 100 can be provided with at least one stay-away zone 160")) and are depicted as having the same hourglass configuration with wings, fasteners 150a-150d, and containment assembly 120.

except for a small portion that remains untreated and forms the stay-away zone). As explained in my paragraphs 68-70, above, the retaining forces between the fasteners 150a-150d and stay-away zone 160 (i.e., untreated nonwoven) are sufficient to hold diaper 100 on a wearer. Karami '772 at ¶ [0053] (stay-away zone is formed by portion of backsheet nonwoven that is not subjected to water jet treatment). This is further illustrated by Karami '626's diaper which utilizes only two fasteners—of the same type that is used in Karami '772's examples—to connect to an untreated nonwoven that is “suitable for use by both large- and small-waisted persons.” Karami '626 at FIGs. 9-10 and ¶¶ [0039], [0055] and [0060] (“Binder ... #42-288-HX-200-PP3,” which is the Binder 25445). A POSITA would have understood Karami '772's four fasteners, when connected to its untreated nonwoven, would have yielded sufficient retaining forces to secure diaper 100 around a wearer, when in use.

76. Further, Karami '772 contemplates that portions of backsheet 130's nonwoven underlying containment assembly 120 may be subjected to his water jet and/or aperturing treatments to increase the affinity thereof for hook-type fasteners. Karami '772 at ¶¶ [0036] and [0053]. A POSITA would have recognized that fasteners 150a-150d, when attached in this portion of the backsheet, also would have

yielded sufficient retaining forces to secure the diaper around a wearer while in use.



Annotated Version of Karami '772's FIG. 8
("Annotated9")

77. Thus, while mechanical fasteners 150a-150d can releasably engage either wings 131 and 133 or the central portion of backsheet 130 to secure diaper 100 around a wearer, the retaining forces are higher when the fasteners are attached to the wings than when attached to the central portion's stay-away zone 160. See Karami '772 at ¶¶ [0047]-[0048], and [0053] and FIGs. 6 and 8. A POSITA would

have understood that such differential retaining forces facilitate proper diaper sizing by encouraging wearers to attach fasteners 150a-150d to wings 131 and 133 (discouraging the attachment to at least a portion of backsheet 130), the same purported objective of the Diaper Patents' differential retaining forces. *See* Damaghi at ¶¶ [0021], [0024], and [0049]-[0051] and FIG. 3 (Damaghi's diaper 10 similarly includes a central stay-away zone 100 that, while structured such that fasteners cannot attach to it (e.g., by comprising an exposed film) rather than having decreased affinity thereto, permits "a wide range of fastener placement while preventing improper sizing of the diaper"); *see* Karami '626 at ¶ [0069] (higher affinities "play[] an importan[t] role psychologically in providing reassurance against accidental opening of a fastened assembly"); '788 Patent at 9:2-26. In this way, a consumer, whose waist size is smaller than that intended by the manufacturer, would be able to identify improper sizing of a diaper without rendering the diaper useless for the smaller wearers. This proves advantageous by both directing consumers to the best-fitting product and preventing unnecessary waste from improperly-sized purchases.

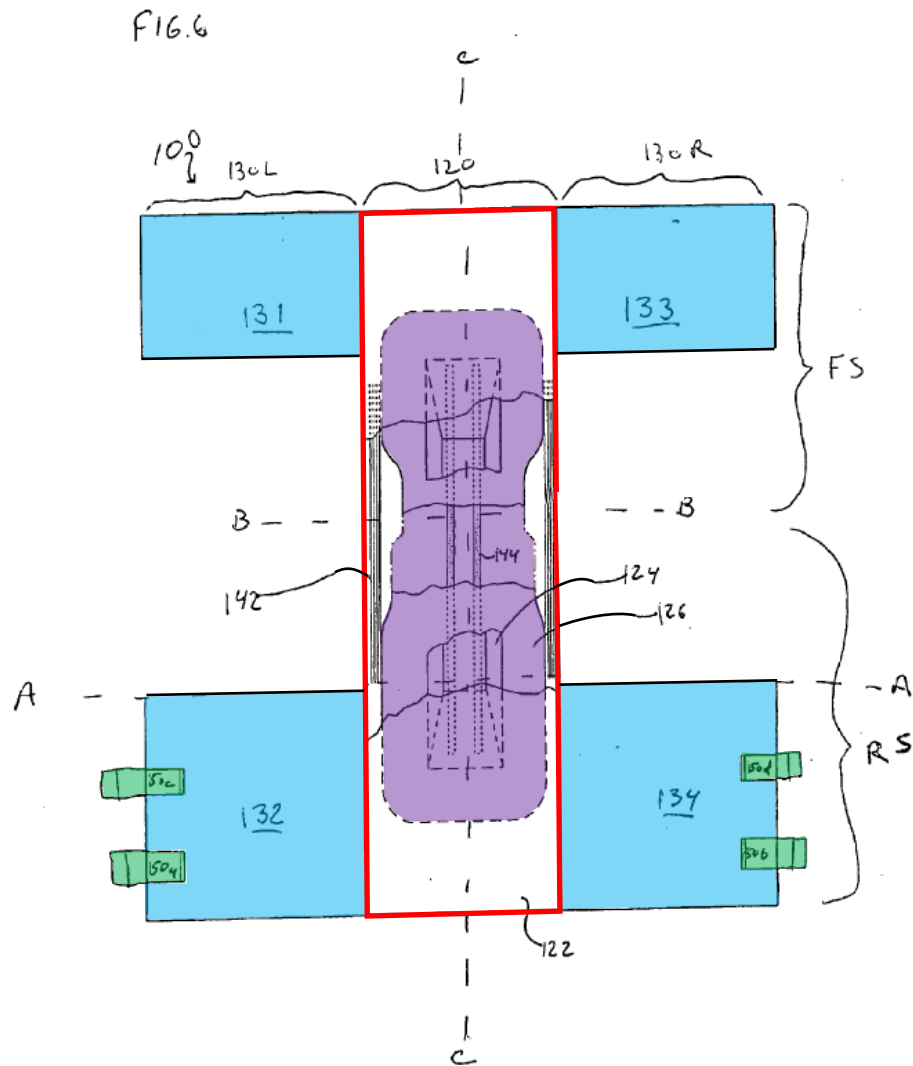
1. It Would Have Been Obvious to Modify Karami '772's Diaper to Utilize Benning's Separate-Chassis-And-Wings Configuration

78. It would have been obvious to construct Karami '772's diaper in accordance with Benning's configuration, e.g., with separate wings that are distinct from the backsheet bonded to the edges of a central chassis as illustrated below in a modified version of Karami '772's FIG. 6. Karami '772 itself suggests such a

construction: one of its illustrative diapers is a T-shaped diaper 10 with separate, treated nonwoven wings 40 attached to a chassis (*see* Karami '772 at ¶¶ [0032] and [0035] and FIG. 1), and it teaches that “[a]s in the wings of the previously-described T-shaped diaper, the wings 131 and 133 of the diaper 100 can be made of any single layer or multi-layer bonded nonwoven.” Karami '772 at ¶ [0048]. Karami '772's focus on “wings 131 and 133 ... be[ing] made of any ... bonded nonwoven” would have invited a POSITA to use wings that are separate from and not necessarily the same material as the backsheet, particularly because Karami '772 teaches that its “invention is meant to encompass absorbent articles having any other suitable structure that incorporates the inventive concept of a bonded nonwoven that is water jet treated and/or apertured to enhance shear and peel strength of the fastening system.” Karami '772 at ¶¶ [0048], [0052], and [0054] (“It should be appreciated that a bonded nonwoven subjected to water jet treatment and/or aperturing as described herein may be used in any configuration in an absorbent article” (emphasis added)).

79. In the modified version of diaper 100, a POSITA would have constructed containment assembly 120 analogously to Benning's chassis 20—with absorbent core 126 that is narrower than backsheet 130 disposed between the liquid-impermeable backsheet and liquid-permeable topsheet 122 such that liquids can reach the core through the topsheet and the egress thereof is prevented by the

backsheet—and attached nonwoven side panels 131-134 to the assembly's side edges at its front and rear portions, optionally such that the wing material is not in the crotch region thereof. *See* Karami '772 at ¶¶ [0047] and [0052]; Benning at ¶¶ [0053]-[0054] and FIG. 4.



Modified Version of Karami '772's FIG. 6
("Annotated10")

80. As the Diaper Patents acknowledge, such a configuration was well-known. '788 Patent at 1:9-22. A POSITA would have understood that constructing diaper 100 in this manner would be beneficial. Additionally, the width of the unitary backsheet in unitary hourglass constructions required production machines to be at least as wide as the unfolded diaper, which was disadvantageous for manufacturing. *See* Glaug at 4:28-37 (alluding to the complexity of such a manufacturing technique). Manufacturers used constructions with separate wings attached to a chassis to address these shortcomings and more economical production. *See, e.g.,* Glaug at 19:27-33 (“since the absorbent articles of this invention are formed of respective individual sections which are secured together during the manufacturing/assembly process, the panels making up the various sections can be readily die cut and brought into engagement on an efficient and economical basis”).

81. Additionally, with separate diaper components, manufacturing equipment could be readily adapted to alter individual components, yielding manufacturing flexibility. *See, e.g.,* Glaug at 20:4-39. And “[f]urther economies c[ould] be achieved.” Glaug at 20:40-51.

82. Using separate wings attached to a chassis also would have provided a simple way to use separate materials for the chassis and wings, which a POSITA would have been motivated to do. For example, as I explain below in my paragraphs 92-95, a POSITA would have been motivated to use a higher basis weight nonwoven

for wings 131-134 for strength and a lower basis weight nonwoven for containment assembly 120's backsheet for comfort.

83. Additionally, a POSITA would have understood that containment assembly 120's backsheet 130, which faces away from a wearer, should be liquid-impermeable to prevent bodily fluids from passing through to the wearer's garments. *See, e.g.*, Karami '772 at ¶ [0031]; Benning at ¶ [0003] (“the main body portion, often described as the chassis, can be configured to be fluid-impermeable”); Rohrl at ¶ [0027] (“[t]he chassis has a liquid impermeable layer 7 on its side facing away from the body of the user”). A POSITA thus would have used a film-nonwoven laminate for containment assembly 120's backsheet 130 as Karami '772 teaches, with the film facing absorbent core 126 to prevent the egress of liquids and the nonwoven defining the containment assembly's entire outer surface to yield a cloth-like feel. *See* Karami '772 at ¶¶ [0031] and [0052]. It also would have been obvious to render the impermeable film of backsheet 130 breathable (i.e., to permit water vapor and air to pass therethrough) as Karami '772 teaches to promote wearer comfort, such as by modifying the film such that it includes micropores as was well-known. *See* Karami '772 at ¶¶ [0031] (the backsheet “may also be a composite of a film and at least one nonwoven layer” where the film is “vapor and air permeable but liquid impermeable”); Anderson at 1:28-34 and 2:64-3:17 (“The modified web has a microporous structure containing few large pores and capillaries” and thus “is

breathable to air or vapor, but acts as a liquid barrier,” which “help[s] maintain dryness and [] reduce[s] the humidity adjacent the wearer’s body”); McCormack at 1:42-58 (“When fillers are used, the film is often crushed between rollers to crack the filler or stretched so as to create small gaps between the polymer and the particles embedded in the polymer” which “creates a tortuous path from one surface of the film to the other and thus provides a path for the escape of water vapor”).

84. By contrast, a POSITA would have understood that wings 131-134 need not be liquid-impermeable because bodily fluids do not reach them. *See, e.g.*, Miyamoto '930 at 7:25-30 (“The plastic film 27 is not provided in the front and rear ear panel areas 30 and 31, since the plastic film 27 is not needed where there is no core material 28 to absorb exudates, particularly urine.”). While the backsheet film could be breathable as discussed above, a POSITA would have understood that it would not be as breathable as nonwoven materials whose open, fibrous structure allowed water vapor and air to pass through at a faster rate than through such films’ micropores. For example, in my experience, the moisture vapor transmission rate (MVTR), which reflects a material’s breathability, of backsheets incorporating breathable films was typically on the order of 1,500-5,000 g/m²/24 hr while the MVTR of nonwovens was typically an order of magnitude higher, such as at least 10,000 g/m²/24 hr. *See, e.g.*, Anderson at 21:53-22:32 (breathable backsheet MVTR

is 500-5000 g/m²/24 hr measured according to a test method that, as described, is the ASTM E96 dry-cup method).

85. Because breathability was important for wearer comfort, diapers commonly omitted the impermeable film from the wings (which could be liquid-permeable) such that they had greater breathability than the backsheet. *See, e.g.*, Damaghi at ¶¶ [0013] and [0052]-[0053] (side panel breathability “ensure[s] the comfort of the wearer”) and [0057] (“film 28 does not extend sufficiently into the wings of backsheet 30 to render the sides of diaper 10 liquid and/or vapor impervious”); Miyamoto ’930 at 7:25-30 and 11:53-60 (with no film in the ears, there is “better breathability and softness in the ear regions” such that “[w]earer comfort is ... increased”); Benning at ¶¶ [0003], [0032], and [0053] (the wings “can breathe, in particular, can be configured to be air- and vapor-permeable, whereas the ... chassis[] can be configured to be fluid-impermeable”); *see also* Karami ’772 at ¶ [0031] (“The width of the film layer may be narrower than the outer nonwoven layer.”). Doing so also reduced costs associated with laminating a film to a nonwoven. A POSITA would have been motivated to do the same with Karami ’772’s diaper 100 to attain these benefits, and using Benning’s separate-piece construction would have been a straightforward way of doing so (e.g., such that the nonwoven for wings 131-134 and film-nonwoven laminate for backsheet 130 could be produced separately).

86. Such a modification would have been straightforward and routine for a POSITA, who would have been familiar with such a well-known diaper construction, and predictably yielded these benefits.

2. *It Would Have Been Obvious to Fold and Releasably Bond the Wings of Karami '772's Diaper in View of Benning*

87. In addition to using Benning's separate-chassis-and-wings configuration, it would have been obvious to fold wings 131-134 of Karami '772's diaper 100 "over themselves at least along one fold line running in the longitudinal direction" in the manner Benning's diaper's side flaps 34 are folded upon themselves as I described in my paragraph 65. See Benning at ¶¶ [0006]-[0007] and [0055]-[0060] and FIGs. 4-6 and 8. For example, a POSITA would have been motivated to fold wings 131-134 about multiple longitudinal fold lines such that partial sections thereof are folded upon each other and lie against one another, with the partial sections maintained in the folded configuration using releasable affixation points or areas (e.g., from ultrasonic welding). See Benning at ¶¶ [0006]-[0008], [0020], and [0056]-[0060] and FIGs. 4-8. Notably, Karami '772 itself contemplates folding of its diapers' wings. See Karami '772 at ¶ [0037] ("The aperturing step may take place after the nonwoven feed roll and before a folding station at which the wings are folded.").

88. As Benning teaches, such folding and affixation would have facilitated manufacturing by preventing the side flaps from fluttering during production and

made it easier to apply the diaper to a side-lying patient. Benning at ¶¶ [0007], [0020], and [0025]; *see also* Karami '584 at ¶¶ [0006]-[0009] and [0021] and FIGs. 1 and 3-6 (folding and temporarily bonding wings in its “efficient and commercially viable method of manufacturing absorbent articles”). Folding wings 131-134—particularly along at least two fold lines as Benning teaches to be preferable—would have decreased the footprint of diaper 100 and thus “facilitate[d] stacking, packaging and storage of the final product (diaper) prior to shipment for use” and maintained “a neat appearance.” Benning at ¶¶ [0022] and [0025]; Karami '584 at ¶ [0021]. Additionally, having releasable attachment would have permitted easy deployment of wings 131-134 for use, e.g., with “a single pull.” Benning at ¶¶ [0020]-[0021], [0025], and [0058]. These benefits would have motivated the folding of wings 131-134. Thus, to achieve these benefits, a POSITA would have folded and temporarily affixed Karami '772's wings 131-134 as Benning teaches.

89. Such a modification would have been straightforward and routine for a POSITA, involving the application of well-known folding and bonding techniques during manufacturing, and would have predictably achieved the above-described benefits.

3. *It Would Have Been Obvious to Use Nonwovens Having Basis Weights Within the Diaper Patents' Ranges for Karami '772's Backsheet and Wings*

90. The Diaper Patents state that the nonwoven of their backsheet can have a basis weight that is 10-30 gsm (such as 14-25 gsm or 18-22 gsm) and the nonwoven of their wings can have a basis weight that is 18-60 gsm (such as 25-45 gsm, 27-40 gsm, or 28-35 gsm). '788 Patent at 7:9-18 and claims 11 and 18; *see* '398 Patent (claims 12-15, 28, and 30); '249 Patent (claims 8, 11, 23, 33, 47, and 49); '990 Patent (claims 12-14 and 21). Basis weights within these ranges would have been obvious options for the nonwovens of wings 131-134 and backsheet 130 that a POSITA would have selected when balancing nonwoven performance with its cost.

91. Karami '772 indicates that the nonwoven of its backsheet 130—and thus wings 131-134—can have a basis weight that is 5-45 gsm, which encompasses the Diaper Patents' backsheet basis weight range and overlaps their wing basis weight range. Karami '772 at ¶¶ [0031] (basis weight of T-shape diaper 10's backsheet 32) and [0047] and [0052] (the backsheet, which defines the wings, “may be formed of the above-identified nonwoven layered with a polypropylene or polyethylene film”). With diaper 100 constructed such that wings 131-134 are separate from containment assembly 120's backsheet 130, a POSITA would have had greater flexibility in choosing the basis weights for the wings and backsheet (e.g., because different basis weights could be used for the wings and backsheet).

92. Factors a POSITA would have considered in making the basis weight selection included cost, comfort, and strength. Higher basis weight nonwovens tended to be more expensive and heavier because they included more material, which for a POSITA would have weighed in favor of lower basis weight materials. *See, e.g.,* Young at 6:40-44 (factoring the “higher cost of higher basis weight materials” into its design choice). Additionally, when selecting basis weight, there was generally a trade-off between nonwoven softness and strength, with higher basis weight nonwovens tending to be stronger and lower basis weight nonwovens tending to have a more “cloth-like” feel. *See, e.g.,* Young at 1:21-41 (“[W]hile strength and coverage may be increased by an increase in basis weight, the softness tends to decrease.”). For this reason, it was known to use different basis weight nonwovens for different diaper components to satisfy different strength and comfort criteria thereof. *See, e.g.,* Kleinschmidt at 2:19-32 and 8:11-38 (high basis weight region “provide[s] a side panel delivering the material strength needed for securing a fastening device to the diaper” while the lower basis weight region “deliver[s] a softness that is comfortable to the wearer’s skin”); Horn at ¶ [0006] (the “problem” of nonwoven fibers being “pulled lose” upon “disengaging of a hook member” is “especially significant for low basis weight nonwoven webs”).

93. In view of these design considerations, a POSITA would have used a nonwoven having a basis weight within 10-30 gsm (e.g., 20 gsm) for Karami ’772’s

backsheet 130. A POSITA would have understood that a nonwoven with a basis weight around 20 gsm would provide the cloth-like feel that was desirable for diaper backsheets while being relatively inexpensive with its lower basis weight. *See, e.g.*, Sun at 8:3-28 (“20 gsm ... spunbond polypropylene nonwoven web” is an example of a backsheet that “desirably ... provides a generally cloth-like texture”); Couillard at ¶ [0060] (same). This is in part why such basis weight nonwovens were often used and considered desirable for backsheets, even if different nonwovens were used for other diaper components. *See, e.g.*, Karami ’626 at ¶ [0065] (“relatively lower basis weights of 15-30 gsm (optimally 20 gsm) are preferred for the backsheet of the front and back portions”); Sun at 8:3-28 (20 gsm spunbond nonwoven). Furthermore, Karami ’772 confirms that its backsheet’s nonwoven can have a 20 gsm basis weight. *See* Karami ’772 at ¶¶ [0041], [0046]-[0047], and [0052] and TABLE 1 (using 20 gsm basis weight nonwoven for his example, which is part of backsheet 130).

94. These design considerations similarly would have led a POSITA to use a nonwoven having a basis weight within 18-60 gsm, such as around 30-35 gsm, for Karami ’772’s wings 131-134. Karami ’772 at ¶¶ [0031], [0041], [0046]-[0047], and [0052] and TABLE 1 (preferring 5-45 gsm and using a 33.9 gsm nonwoven for his example); Karami ’626 at ¶¶ [0065] (“slightly higher basis weights of 20-40 gsm (optimally 34 gsm) are preferred for use on the wings”). A POSITA would have

understood that wings 131-134 may have to withstand larger forces than backsheet 130 and, as the material to which fasteners 150a-150d engage, desirably have a basis weight by which the nonwoven has enough fibers to “provide the nonwoven with the strength necessary to provide a high level of shear strength” and resists tearing when the fasteners are disengaged therefrom (e.g., during fastener repositioning to adjust the diaper fit). *See, e.g.*, Karami ’626 at ¶¶ [0065] and [0067]-[0068]; Kleinschmidt at 2:19-32 and 8:26-39 (higher basis weight region of the side panel “deliver[s] the material strength needed for securing a fastening device to the diaper”); Horn at ¶¶ [0006] (the problem of “hook[s] tend[ing] to pull fibers loose” from the nonwoven “upon disengaging of a hook member” is “especially significant for low basis weight nonwoven webs”).

95. As reflected above, this would have weighed in favor of using a higher basis weight nonwoven and led a POSITA to select a nonwoven basis weight within the Diaper Patents’ ranges, which encompass well-known basis weights for nonwoven wings, including those Karami ’772 specifically offers for its wings 131-134. Karami ’772 at ¶¶ [0041], [0046]-[0047], and [0052] and TABLE 1; *see, e.g.*, Benning at ¶ [0032] (flaps 34 “advantageously have a surface weight” that is “25-50 g/m²”); Karami ’626 at ¶¶ [0065] and [0067]-[0068] (“20-40 gsm (optimally 34 gsm) are preferred for use on the wings”); Stupperich at ¶¶ [0019]-[0022] (overall nonwoven laminate basis weight is “preferentially 50 to 65 g/m²” with the nonwoven

to which the hooks engage being “20 to 35 g/m² ... ensure[s] good closing function in cooperation with a hook-forming component” and has “good mechanical properties” for use “as a belt in absorbent hygiene articles”).

96. These basis weight selections would have been routine for a POSITA, who would have been familiar with nonwovens and how their basis weights affect the properties of diaper components, and would have predictably yielded the above-described benefits.

4. It Would Have Been Obvious to Use the Claimed, Workable Retaining-Force Ranges in the Modified Karami '772 Diaper

97. As explained above, Karami '772's diaper 100 provides size adjustability, addressing the shortcomings of prior diapers that required a landing zone for their hook fasteners. Karami '772 at ¶¶ [0003], [0005], [0009], and [0048] (“the fastening of the hook-type fasteners 150a-150d ... is not restricted to specific landing zones”); my paragraphs 66, 67, and 74. At the same time, as I discussed in paragraph 77, a POSITA would have understood that stay-away zone 160's “diminished affinity to hook-type fasteners in relation to the remainder of the front waist portion” discourages a user from attaching fasteners 150a-150d thereto because users prefer attachment to the high-affinity treated portions where there is more perceived “gripping.” See Karami '772 at ¶ [0053]; Karami '626 at ¶ [0069] (higher affinities “play[] an importan[t] role psychologically in providing reassurance against accidental opening of a fastened assembly”). Such

discouragement facilitates proper diaper sizing—an advantage known to mitigate waste—but does not eliminate diaper 100’s size adjustability, particularly because fasteners 150a-150d have sufficient affinity with stay-away zone 160’s untreated nonwoven to maintain the diaper around a wearer. *See* Damaghi at ¶ [0007] (“diapers that are too large may still be nominally fitted to an individual” but “[t]his practice is wasteful”); my paragraphs 69, 70, and 77. In this manner, a POSITA would have understood that Karami ’772 strikes a balance between size adjustability and encouraging proper diaper sizing, with the different fastener affinity across the front of diaper 100 signaling to users the preferable attachment location for fasteners 150a-150d while still allowing users with smaller-than-optimal waists to use the diaper by attaching the fasteners to the central stay-away zone 160.

98. The Diaper Patents purport to achieve the same balance using the same mechanism: “[t]he materials forming the outer face of the main part and the outer face of the side parts ... serve as the engagement surface for the closure means,” where the retaining forces the closure means yield with the main part are smaller than those they yield with the side parts such that “the users of the diapers tend to close the diaper in such a way that the closure means are secured on ... the side parts.” ’788 Patent at 2:9-37. The Diaper Patents also disclose a broad range of over-abdomen retaining forces (shear forces, which can be measured using the Diaper Patents’ non-standard test method) between their fasteners and nonwovens

through which this can be carried out: 20-90 N/25 mm, with the lower portion of the range (20-57 N/25 mm, and more particularly 25-50 N/25 mm) yielded at the main part and the upper portion of the range (58-90 N/25 mm, and more particularly 60-80 N/25 mm) yielded at the side parts. *See* '788 Patent at 2:27-37; *see also* '788 Patent at claims 2 and 3; '249 Patent at claims 3, 4, 14-16, 25, 32, 36, 37, 39-40, 44, 50, 53, and 54; '398 Patent at claims 2-4, 16, 27, 28; '990 Patent at claims 3-6 and 2. However, the Diaper Patents do not assign a particular rationale or significance to these ranges. *See* '788 Patent at 2:27-37. Instead, a POSITA would have recognized that the ranges simply encompass retaining forces through which Karami '772's and the Diaper Patents' shared size-adjustability-and-proper-size-encouragement objective could be carried out, with (independently or taken together) retaining forces within the lower ranges (20-57 N/25 mm and 25-50 N/25 mm) being logical options at the "diminished affinity" stay-away zone 160 and retaining forces within the higher ranges (58-90 N/25 mm and 60-80 N/25 mm) being logical options at the "enhance[d] peel and shear strength" wings. *See* Karami '772 at ¶¶ [0048] and [0052]-[0053]. Stupperich, for example, illustrates a POSITA's understanding of over-abdomen retaining forces (shear forces) between nonwovens and fastener comprising hooks that are suitable for holding a diaper around a wearer: it targets

“a shearing force of at least 5 N/25 mm and at most 80 N/25 mm,”² confirming that through the routine design process of the Karami ’772-Benning diaper a POSITA would have arrived at retaining forces within the Diaper Patents’ broad lower ranges (20-57 N/25 mm and 25-50 N/25 mm) in lower-affinity stay-away zone 160 and retaining forces within the Diaper Patents broad upper ranges (58-90 N/25 mm and 60-80 N/25 mm) in higher-affinity wings 131 and 133. Stupperich at ¶¶ [0001], [0007], [0028], and [0034].

99. A POSITA would have been able to achieve retaining forces within the Diaper Patents’ ranges with a routine selection and tailoring of the nonwoven materials of wings 131 and 133 and backsheet 130. First, as I explain in further detail below in paragraphs 120 and 121, a POSITA would have recognized that nonwoven basis weight affects retaining forces, with higher basis weights yielding higher retaining forces (because there is more material available for hook engagement) and vice versa. *See, e.g.*, Gorman at 2:35-39 (the sheet of fibers preferably has a higher basis weight . . . so that more loops are available for

² A POSITA would have understood the shear strengths Stupperich describes are those measured using the same test method as used in the Diaper Patents. *Compare* Stupperich at ¶¶ [0036]-[0045] and FIGs. 4 and 5A-5B *with* ’788 Patent at 2:34-4:28 and FIGs. 8 and 9A-9B.

engagement by the hook portion of the fastener”); Gehring at 5:3-7 (“more hooks and loops [] engaged” provides “high[er] peel and shear strength[s]”). A POSITA would have selected from the broad ranges of basis weights and materials described as suitable in Karami ’772 and Benning in carrying out this tailoring of the backsheet and wing nonwovens. *See* Karami ’772 at ¶¶ [0046] and [0048] (wings 131-134 and backsheet 130 can each be “any single layer or multi-layer bonded nonwoven”), [0031] and [0046] (5-45 gsm basis weight for the wing and backsheet nonwovens); Benning at ¶ [0032] (the wings’ preferred nonwoven basis weight is “10-150 [gsm], in particular 20-100 [gsm], and specifically [] 25-50 [gsm]”). For example, as I noted above in Section VII.B.3, basis weight options a POSITA could have selected included those within the ranges the Diaper Patents describe, such as 10-30 gsm or 18-22 gsm (e.g., around 20 gsm) for the backsheet and 18-60 gsm (e.g., around 30 gsm) for the wings.

100. Further, in carrying out the routine design process, a POSITA could have applied various well-known treatments affecting the retaining forces. For film-nonwoven laminate backsheet 130, a well-known temperature treatment (e.g., annealing)—described in further detail in Section VII.G—would have caused the nonwoven thereof to “gather and bulk up between adjacent bond sites” and thereby increased the over-abdomen retaining forces between fasteners 150a-150d and the backsheet. *See* Jacobs at 6:6-11; Gorman at 2:27-47 (similar thermal-treatment-

caused gathering to make a loop material, albeit in a different process than Jacobs, increases basis weight). For wings 131 and 133, a POSITA would have tailored Karami '772's water jet treatment and/or aperturing to tailor the resulting retaining force increase in the wings. *See* Karami '772 at ¶¶ [0036] and [0037] (describing water jet treatment and aperturing parameters that can be varied).

101. Additionally, for both wings 131 and 133 and backsheet 130, a POSITA could have bonded nonwoven fibers together at points or areas (e.g., via thermal embossing) to mitigate fiber tearing during hook engagement, with a wide range of bonding areas to select from to strike a workable balance between tear resistance (promoted by larger bonding areas) and retaining forces (promoted by lower bonding areas, which allows more fibers available for hook engagement). *See* Karami '772 at ¶¶ [0045], [0048], and [0052] and claim 33 (backsheet and wings each comprise “bonded nonwoven material”); Karami '626 at ¶¶ [0062] and [0068] (nonwovens are preferably “point bonded by a thermal technique such as calendering” such that the “percentage bonding area [is] about 15-30%”); Section VII.J.3 (explaining thermal embossing in Karami '772 and Karami '626); Stupperich at ¶¶ [0007]-[0010] and [0018] (describing tradeoff between retaining forces and tear resistance from bonding fibers, with bonded area “account for 10 to 60% ... and in a particularly advantageous manner 19 to 22% of the total area of the [nonwoven] surface”).

102. Furthermore, a POSITA would have been familiar with fasteners that can engage with nonwovens to yield these retaining forces, including the “Microplast® 42-288-HX200-PP3, item number 25445” Binder fastener used in the Diaper Patents. *See* ’788 Patent at 15:24-37; Karami ’772 at ¶ [0041] (same Binder 25445 fastener); Karami ’626 at ¶¶ [0058], [0060], and [0070] (the same Binder fastener is one of the “preferred fastener element[s]” that can engage with “conventional nonwovens” and should have a size within a range encompassing the Diaper Patents’ 20x25 mm fastener (0.5-1 inch wide and 1-2 inch long)); Stupperich at ¶¶ [0038] and [0046] (using the same Binder fastener of the same size). Even when using fasteners having adhesive in addition to the hooks as I describe in further detail below in Section VII.E, the same shear strengths between the fasteners and nonwoven would have been obvious results arrived at in the routine design process, particularly because (relative to hooks) fastener adhesive yields a relatively small contribution to shear strength when engaged with a nonwoven. *See* Neugebauer at ¶¶ [0013], [0015]-[0017], and [0022] (with a fastener having both adhesive and hooks, the adhesive serves as the “pop-off securing means” because it contributes more to the peel strength, while the hooks serve as the “shear-off securing means” because they are the dominant contributor to peel strength with a nonwoven).

103. The Diaper Patents only offer known materials and known techniques of treating those materials to achieve retaining forces within the ranges they disclose,

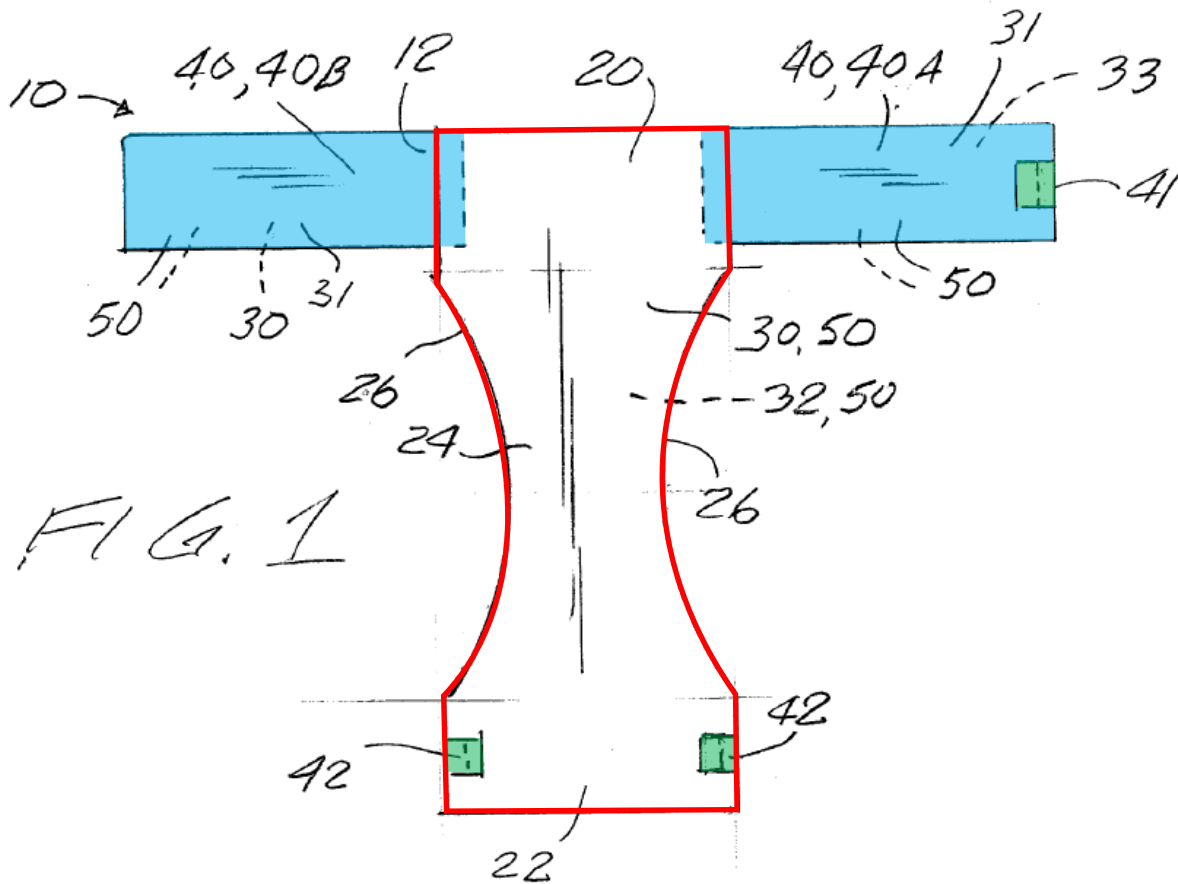
confirming my opinion that through the routine design process a POSITA would have recognized retaining forces within those ranges as logical options for achieving Karami '772's size-adjustability-and-proper-size-encouragement objective and would have been capable of achieving them. *See* '788 Patent at 6:16-35 (“all nonwovens are suitable that contain ... a thermoplastic polymer”), 7:12-18 (the backsheet nonwoven basis weight “is preferably 10-30 [gsm]” and wing nonwoven basis weight “is preferably 18-60 gsm”), 7:19-26 (a higher retaining force is “[d]ue to” a higher basis weight) and 13:34-41 (higher retaining forces are “essentially ensured” by higher basis weights), 8:8-28 (temperature treatment that causes backsheet's nonwoven to “gather” increases retaining force), 8:3-7 (using the “known ring-rolling method” on the film-nonwoven laminate backsheet), 6:35-40 (fiber-bonding strengthens a nonwoven), 14:4-10 (embossing area “is preferably 15 to 50%”), 15:24-37 (using the same “Microplast® 42-288-HX200-PP3, item number 25445” fastener as Karami '772 (Karami '772 at ¶ [0041]), Karami '626 (Karami '626 at ¶ [0060]), and Stupperich (Stupperich at ¶ [0046])).

C. Karami '626

104. Karami '626 describes absorbent articles—including T-shaped briefs, traditional diapers, and pull-up diapers—that, like those of Karami '772, include a nonwoven to which minihook fasteners can attach without the need for a separate loop component. Karami '626 at ¶¶ [0003]-[0004], [0006] (describing lack of “size

adaptability” in prior diapers due to use of “corresponding miniloop fastener element[s]” that are not practical to place over the “entire surface of an article”) and [0007]-[0011] (Karami ’626 “the fastener assembly is composed exclusively of a minihook fastener element and a nonwoven” which “provides size adjustability ... at the cost of only additional minihook fastener elements”). As Karami ’626 teaches, this permits the minihook fasteners to “engage directly with any portion of the nonwoven surface constituting the frontsheet [], backsheet [,] or wings” such that the diaper’s size can be adjusted to accommodate “both small and large-waisted persons.” Karami ’626 at ¶¶ [0010] and [0039]-[0041].

105. Karami ’626’s FIG. 1 (annotated below) shows one of Karami ’626’s absorbent articles 10. Karami ’626 at ¶ [0035]. While article 10 is a T-shaped brief 12, Karami ’626 teaches that it can be a diaper or pull-up brief, where “the same or analogous improvements in the fit, appearance and economy” are realized for each type of article. Karami ’626 at ¶¶ [0035] and [0055] and FIGs. 1 and 8-10.



Annotated Version of Karami '626's FIG. 1
("Annotated11")

106. Article 10 has a chassis [red outline] comprising a “a crotch portion 24 connecting the back and front portions 20, 22” and a frontsheet 30 (commonly referred to as a topsheet) that faces a wearer when the article is worn, a backsheet 32 that faces away from the wearer when the article is worn, and an absorbent core disposed between the frontsheet and the backsheet. Karami '626 at ¶¶ [0035]-[0036] and FIGs. 1 and 2. Article 10, when a T-shaped brief, comprises two wings 40 [blue] bonded to and “extend[ing] laterally from respective lateral edges of back

portion 20.” Karami ’626 at ¶ [0037] and FIG. 1. Wings 40 can “form (with the back portion 20) a belt 44 encircling the waist of the wearer,” with “fastener elements 42” [green] engaging “the exposed outer surface of the belt 44” to maintain article 10 in the closed position. Karami ’626 at ¶¶ [0037]-[0038] and FIG. 7. When the article is a diaper 14, fastener elements 76 can be attached to “adjacent opposed lateral edges of the back portion 20” and releasably engage with backsheet 32 at the diaper’s front portion 22. *See* Karami ’626 at ¶ [0055] and FIGs. 9-10.

107. The entire outer surface 33 of wings 40 and backsheet 32 can comprise a nonwoven (without other fastening materials beyond the nonwoven) such that the hook fasteners “may engage directly with any portion” thereof, which provides article 10 with the size adjustability purportedly absent from prior diaper designs. *See* Karami ’626 at ¶¶ [0038]-[0040] and [0062]-[0065]. As described for his T-shaped diaper 12, the flexibility in where the fasteners can engage wings 40 permits “the degree of overlap in the connection between the wings 40 ... [to] vary” such that the diaper can accommodate “both large- and small-waisted persons.” Karami ’626 at ¶¶ [0039]-[0040]. A POSITA would have understood the same benefits apply to his other diaper configurations and that the aforementioned “same or analogous improvements in the fit” come from the fastener elements being able to releasably engage with any portion of the diaper (e.g., in the wings or central portion). *See* Karami ’626 at ¶¶ [0037]-[0040] (tape tab fastener elements 41, 42

“may engage directly with any portion of the nonwoven surface constituting the frontsheet 30, backsheet 32 or wings 40”) and [0055] and FIGs. 9-10 (tape tab fasteners elements 76, as depicted, analogously can attach to any portion of the diaper’s outer surface to accommodate different wearers’ waist sizes).

108. Per Karami ’626, nonwoven 50 that “defines an exposed outer surface of at least one of the frontsheet 30, backsheet 32, and wings 40” is, similar to the nonwoven to which the Diaper Patents’ fasteners attach, preferably a spunbond nonwoven. Karami ’626 at ¶¶ [0062]-[0063]; ’788 Patent at 6:31-35 (“Spunbond nonwovens are especially preferred because they possess high strength in the longitudinal and transverse direction and therefore withstand the lateral forces exerted on them due to the engagement of the mechanical closure aids especially well.”). It “preferably ... ha[s] a basis weight of 13-50 grams per square meter (gsm)” where, when wings 40 are attached to the chassis and thus need not comprise the same nonwoven as backsheet 32, “slightly higher basis weights of 20-40 gsm (optimally 34 gsm) are preferred for use on the wings” and “relatively lower basis weights of 15-30 gsm (optimally 20 gsm) are preferred for the backsheet.” Karami ’626 at ¶ [0065]. Backsheet 32’s nonwoven can be laminated “with a polypropylene or polyethylene film backing,” which a POSITA would have understood gives the backsheet its liquid impermeability. Karami ’626 at ¶ [0064].

109. The fibers of Karami '626's nonwoven 50 that "defines an exposed outer surface of at least one of the frontsheet 30, backsheet 32, and wing 40" can be bonded "by a thermal technique such as calendering" similarly to the nonwoven to which the Diaper Patents' fasteners attach. *See* Karami '626 at ¶ [0062]; '788 Patent at 12:58-13:5, 13:12-33, and FIGs. 1-2 (for front side parts 16 and backsheet 10, "[t]he outer face of the nonwoven material has an embossing pattern" with "joining regions produced by hot calander embossing"); *see also* '788 Patent at 13-14:10 and FIGs. 3-4 (discussing various embossing patterns). Additionally, as with the Diaper Patents' nonwovens, only a portion of the area of nonwoven 50 is bonded such that the portions between the bonds are available to be engaged by the fasteners. *See* Karami '626 at ¶¶ [0062]-[0063] (bonding is performed "to produce a fuzzy nonwoven having a percentage bonding area of about 15-30%"); '788 Patent at 7:9-11, 13:3-5, 13:49-52, 14:4-10 ("The proportion of the area covered by the joining points or joining regions is preferably 7-40%, in particular 15-30%, further, in particular 17-25%.").

110. Karami '626's minihook fasteners are "preferred for use only with conventional nonwovens and ha[ve] not been found to be particularly suitable for use with either the conventional VELCRO mini-loop fastener elements or the conventional loop-providing materials intended for use with conventional hook-type VELCRO fastener elements," meaning that they aggressively engage with a variety

of nonwovens but not necessarily with traditional loop material that has been designed and optimized specifically for the hook material's design (e.g., hook shape and density). Karami '626 at ¶¶ [0070] and [0078]. Karami '626's preferred minihook fastener is the same mushroom-hook fastener used in the Diaper Patents' examples. *See* Karami '626 at ¶¶ [0057] and [0060] and FIGs. 11-12 ("preferred fastener element" is "#42-288-HX-200-PP3" from Binder and suitable fastener hooks "have a mushroom-like appearance" that have "an average density of at least 1600 pins per square inch [(248 pins/cm²)]" and are spaced apart by "less than about 300 microns"); '788 Patent at 15:24-37 (using "42-288-HX200-PP3" fasteners from Binder whose "hooks are mushroom-shaped"). To "achieve useful peel and tear strengths, the pin-bearing surface area of the fastener element" is "at least 0.5 inch²," such as with a hook fastener that is "at least one inch [(25.4 mm)] in width by a half inch [(12.7 mm)] in length, optimally at least two inches by one inch." Karami '626 at ¶ [0058].

111. With such nonwovens and fasteners, "the pins of the fastener element enter into the interstices of the nonwoven when the exposed outer surfaces of the fastener element and the nonwoven are mutually engaged" such that the peel and shear strengths between the nonwoven and fasteners are strong enough to maintain the diaper in the closed position. *See* Karami '626 at ¶¶ [0005], [0067]-[0068], [0070], and [0078] ("[t]he fastener assembly provides a peel strength of at least 60

grams per square inch and a shear strength of at least 1300 grams per square inch,” which is “preferred” for securing the diaper).

1. *It Would Have Been Obvious to Modify Benning’s Diaper To Use a Film-Nonwoven Backsheet Like Karami ’626’s to Promote Wearer Comfort and Visual Appeal*

112. It would have been obvious to construct Benning’s diaper to use a liquid-impermeable film-nonwoven laminate for its underlayer 30, with the nonwoven defining the entire outer surface thereof (e.g., without other fastening materials beyond the nonwoven). *See* Section V.C. It was known that these film-nonwoven backsheets were liquid impermeable, via their films, and also provided increased comfort for a user. *See* my paragraphs 30-31; Benning at ¶¶[0033] (“non-woven material [] is experienced as pleasant by the wearer.”); Sun at 8:3-28 (describing a diaper backsheet 30 including a “liquid impermeable inner layer” and a “liquid permeable outer layer ... [that] desirably ... provides a generally cloth-like texture” such as “a 20 gsm ... spunbond polypropylene web”). Karami ’626’s diaper includes such a film-nonwoven backsheet and it would have been a logical selection for Benning’s backsheet. Karami ’626 at ¶¶ [0062]-[0064] (“the backsheet may be formed of the above-identified nonwoven with a polypropylene or polyethylene film backing”); Anderson at 1:51-67 (explaining that “[i]n addition to imperviousness to liquids ... the backsheet also preferably includes a cloth-like outer surface [that]

provides a softer feel[] and ... a more appealing visual appearance” and citing to “a film-coated, nonwoven material” as an example).

113. Using a film-nonwoven laminate like Karami '626's for Benning's underlayer 30 would have, in addition to performing the leakage-preventing function of the underlayer (*see* Benning at ¶ [0053]), provided a more comfortable and visually appealing cloth-like outer surface for Benning's diaper. A POSITA would have seen Karami '626's film-nonwoven laminate as particularly suited to providing the above benefits given the lower (e.g., “optimally 20 gsm”) basis weight of the nonwoven, which was known to promote “a generally cloth-like texture.” *See, e.g.*, Sun at 8:3-28 (“20 gsm ... spunbond polypropylene nonwoven web” is an example of a backsheet that “desirably ... provides a generally cloth-like texture”); Couillard at ¶ [0060] (same). It would be an obvious modification for underlayer 30 to include a film-nonwoven with the nonwoven defining the outer surface of the underlayer. Such film-nonwoven laminates would have also enabled use of hook-type fasteners like that of Karami '626's—and contemplated by Benning (Benning at ¶[0030])—to “[e]ngage directly with any portion of [a diaper's] nonwoven surface[s]” without a landing zone (Karami '626 at ¶ [0040]).

2. *It Would Have Been Obvious to Use Fasteners Like Karami '626's for Benning's Closures to Enhance Size-Adjustability*

114. Benning's diaper includes “a landing zone” on its chassis to which its closures 42 can “grip mechanically” to maintain the diaper in the closed

configuration. Benning at ¶¶ [0030] and [0055] and FIG. 4. As Karami '626 describes, such a fastener-landing zone configuration has limitations on size adaptability because the fastener is not “capable of engaging anywhere along a facing surface of another article or article portion” but instead can only be positioned within the landing zone. Karami '626 at ¶¶ [0003]-[0004] and [0006].

115. It thus would have been obvious to use Karami '626's fastening system for Benning's diaper to provide size adjustability and overcome the disadvantages associated with landing-zone type fasteners. *See* Karami '626 at ¶¶ [0007]-[0010] and [0039]-[0040] (“It is [] an object of the present invention to provide [] an absorbent article” in which “the fastener assembly provides size adjustability ... at the cost of only additional minihook fastener elements”). This would have been straightforward, requiring little modification of Benning's diaper. As was known to be desirable, this modification would have included constructing Benning's underlayer 30 from a film-nonwoven laminate (*see* my above paragraphs 112-113), with the nonwoven defining the underlayer's entire outer surface (e.g., without other fastening materials beyond the nonwoven). *See* Karami '626 at ¶¶ [0040] and [0062]-[0064] (“the backsheet may be formed of the above-identified nonwoven with a polypropylene or polyethylene film backing”); Section V.C (film-nonwoven laminate backsheets were used to achieve a cloth-like feel). Benning's mechanical closures 42—when comprising the type of minihooks that can releasably engage

well with “conventional nonwovens” as Karami ’626 calls for (*see* Karami ’626 at ¶¶[0057]-[0060] and [0070])—would thus be able “engage directly with any portion of the nonwoven surface” of underlayer 30 or Benning’s nonwoven side flaps 34 to secure the diaper around a wearer. *See* Karami ’626 at ¶¶ [0039]-[0040], [0055], and [0078]; Benning at ¶¶ [0030], [0032], and [0055] (side panels “are preferably of a non-woven material, specifically . . . spunbond materials”). Underscoring the straightforwardness of this modification, Benning’s side flaps 34 “preferably [comprise] spunbond materials” having a basis weight of 25-50 g/m² and thus satisfy criteria for Karami ’626’s “preferred nonwoven”; a POSITA would have readily chosen other nonwoven characteristics (e.g., bonding area, fiber size, and intersticy size) such that side flaps 34 satisfy Karami ’626’s other preferred criteria. *See* Karami ’626 at ¶¶[0062]-[0065], [0070]; Benning at ¶ [0032]. A POSITA would simply be able to use hook-type fasteners instead of Benning’s tapes 44—which is suggested by Benning—so that the hooks could engage either the wings or the backsheet for increased adjustability.

116. In this manner, Benning’s diaper would attain Karami ’626’s size adjustability, with closures 42 being able to (1) engage the nonwoven of chassis 20’s underlayer 30 to accommodate small-waisted wearers and (2) engage the nonwoven of front side panels 34 to accommodate large-waisted wearers. *See* Karami ’626 at ¶¶ [0039]-[0041] (“the accommodation of both small and large-waisted persons by

a single brief 12” is simplified, with the wings overlapping to form belt 44 for “a small-waisted person” but not overlapping “[f]or the extra-large waisted wearer” as the wings can be secured “to opposite lateral edges of the front portion 22 by fasteners elements 42 so that the wings 40 form a belt 44 including both the front and back portions 22, 20”) and [0055] (analogous principle for non-T-shape diapers) and FIGs. 7 and 9-10.

3. *The Modified Benning Diaper Has a Lower Basis Weight Nonwoven in Its Backsheet Than in Its Wings, or it Would Have Been Obvious to Modify it as Such*

117. The modified Benning diaper includes a film-nonwoven backsheet like Karami ’626’s—having a preferred basis weight of “15-30 gsm (optimally 20 gsm)” (Karami ’626 at ¶ [0065])—and nonwoven side parts—having a basis weight of “10-150 [gsm] . . . specifically 25-50 [gsm]”). Benning at ¶ [0032]. A POSITA also would have been motivated to use a higher basis weight nonwoven for side panels 34 than for underlayer 30 for the reasons I discussed in Section VII.B.3, which is a choice that would have been facilitated by Benning’s use of side panels that are separate from the chassis. *See* Benning at ¶¶ [0003] (The [side parts], “particularly those attached only to the rear region, can be formed of another material than the main body portion”), [0033], [0054] and FIG. 4. A POSITA would have understood these advantages as described for Karami ’626’s T-shaped diaper would also benefit the modified Benning diaper given that its wings were also separate from the

backsheet, would encircle a wearer's waist when worn, and would be engaged by fasteners. *See* Benning at ¶¶ [0053]-[0055].

118. Karami '626 suggests such a configuration: for its article that similarly has wings separate from the backsheet (the T-shaped diaper), Karami '626 teaches that “slightly higher basis weights of 20-40 gsm (optimally 34 gsm) are preferred for use on the wings ..., while relatively lower basis weights of 15-30 gsm (optimally 20 gsm) are preferred for the backsheet.” Karami '626 at ¶ [0065]. As I explained in paragraphs 92-94, a POSITA would have understood that higher basis weights (e.g., around 30 gsm or higher) tended to promote strength—and thus were warranted for wings that often were subject to higher forces—while lower basis weights (e.g., around 20 gsm) tended to promote comfort and cost-savings and thus were warranted for backsheets that may not need to be as strong as the wings and, covering a large portion of the diaper that receives exudates, have a large impact on wearer comfort.

119. Furthermore, for the reasons discussed in Section VII.B.3, basis weights within the ranges recited in the Diaper Patents would have been obvious options for Benning's side panels 34 and underlayer 30, such as a basis weight of around 20 gsm for the underlayer—Karami '626's optimal basis weight for its backsheet nonwoven—and of around 30 gsm for the side panels, which is confirmed by Benning and Karami '626, which suggest the same. *See* Karami '626 at ¶ [0065];

Benning at ¶ [0032] (the basis weight of nonwoven side panels 34 is “advantageously ... 25-50 g/m²”). Moreover, the breathability of side panels 34 would have been greater than that of underlayer 30 due to the underlayer’s inclusion of an impermeable film as I explained in paragraphs 112-113. *See* Benning at ¶ [0032] (nonwoven side panels 34 “are configured to breathe” which “allows an exchange of air as well as permeability for moisture in the form of vapor”).

120. Because higher basis weight nonwovens have more fibers per unit area with which a mechanical fastener can interact, the retaining forces (e.g., peel and/or shear strength) between the fastener and such a nonwoven are higher than those between the fastener and a lower basis weight but otherwise similar nonwoven. *See, e.g.,* Gorman at 2:35-39 (the sheet of fibers preferably has a higher basis weight . . . so that more loops are available for engagement by the hook portion of the fastener”); Gehring at 5:3-7 (“more hooks and loops [] engaged” provides “high[er] peel and shear strength[s]”). The Diaper Patents confirm this: “[d]ue to the higher mass per unit area of the nonwoven component for the side parts, a higher closure retaining force is possible because the mechanical closure aids can engage with more fiber material.” ’788 Patent at 7:19-26 and 13:34-41 (the higher “over-abdomen retaining forces between the closure means 32 and the outer face of the side parts 16” than those “between the closure means 32 and the outer face of the backsheet

nonwoven material component” is “essentially ensured by the higher mass per unit area of the nonwoven component of the side parts” (emphasis added)).

121. Notably, the basis weight difference appears to be the only structural feature the Diaper Patents explicitly attribute to its different retaining force functionality. *See, e.g.*, ’788 Patent at 7:19-26, 13:34-41, and 14:39-15:49 (using commercially-available nonwovens and fasteners, with the basis weights being different). As such, obvious configurations of Benning’s diapers as modified in view of Karami ’626—with heavier basis weight nonwovens used for side panels 34 than for underlayer 30’s nonwoven—would have included those in which the retaining forces between minihook closures 42 and the front side panels’ nonwovens are higher than the retaining forces between the closures and the nonwoven of the underlayer.

122. Such a modification of Benning’s diaper would have been routine and straightforward to a POSITA, involving merely the incorporation of a well-known film-nonwoven laminate backsheet and minihook fasteners (including those that were commercially-available) and a nonwoven basis weight selection, and would have predictably achieved the above-described benefits.

4. *It Would Have Been Obvious to Use Hook and Nonwoven Materials in the Benning-Karami '626 Diaper That Would Have Yielded the Claimed Retaining Forces*

123. As the Diaper Patents indicate, “over-abdomen retaining forces” within the ranges they recite (20-57 N/25 mm, and more particularly 25-50 N/25 mm, at the backsheet and 58-90 N/25 mm, and more particularly 60-80 N/25 mm, at the wings) and as measured using their non-standard test method occur between minihook fasteners and spunbond nonwovens that were commercially available. *Compare* '788 Patent at claims 2 and 3, '249 Patent at claims 3, 4, 14-16, 25, 32, 36, 37, 39-40, 44, 50, 53, and 54, '398 Patent at claims 2-4, 16, 27, 28, and '990 Patent at claims 3-6 and 21 *with* '788 Patent at 14:42-15:49 (wings (Material X) comprised a “30-g/mm² [sic]³ polypropylene spunbond nonwoven” and the backsheet’s nonwoven (Material Y) was “a 20-g/m² polypropylene spunbond nonwoven,” both “available from Corovin GmbH,” and the fastener was a “20x25 mm[] [t]ype Microplast® 42-

³ A POSITA would have understood that the basis weight is 30 g/m² rather than 30 g/mm² because a 30 g/mm² (30 million grams/m²) is not a realistic nonwoven basis weight and falls far outside of the ranges described in the '788 Patent at 7:15-18 and the '990 Patent at 7:21-24. The '249 Patent and the '398 Patent each corrected this typographical error. *See* '249 Patent at 14:50-58; '398 Patent at 14:50-58.

288-HX200-PP3, item number 25445, available from G. Binder GmbH & Co KG Textil-und Kunststofftechnik” to yield “over-abdomen retaining forces” of 65.3 N/25 mm at the wings and 48.6 N/25 mm at the backsheet). The same or similar fastening materials as the commercially-available fastening materials would have been obvious options for use in the Benning-Karami ’626 diaper and would have yielded the same or similar over-abdomen retaining forces within the ranges recited by the Diaper Patents.

124. Karami ’626 itself discloses that the Diaper Patents’ known-in-the-art Material Z fastener is preferred. Karami ’626 at ¶ [0060] (preferred fastener element is a “Binder #42-288-HX-200-PP3”). Furthermore, in view of a POSITA’s familiarity with fastener dimensions that are suitable for achieving adequate nonwoven engagement—including for the Material Z fastener—the fastener size used in the Diaper Patents’ example (20x25 mm (0.79 x 1 in)) would have been an obvious option for the Benning-Karami ’626 diaper fasteners. Karami ’626 at ¶ [0058] (disclosing the same Binder 42-288-HX200-PP3 fastener “should be at least 0.5 inch²,” such as “at least one inch in width by a half inch in length” to perform the same functions); *see also* Stupperich at ¶¶ [0038] and [0046] (also using 25 mm wide by 20 mm long Binder Microplast® 42-288-HX200-PP3 fastener).

125. For the Diaper Patents’ example backsheet and side parts, the commercially-available Material X and Material Y nonwovens each include a

polypropylene spunbond nonwoven having a fiber thickness of 2 dtex, a hot calender embossing pattern, and an embossing area of 21.13%, with the side part nonwoven having a higher basis weight (30 gsm) than the backsheet nonwoven (20 gsm). *See* '788 Patent at 14:42-62. A POSITA would have recognized the same Material X and Material Y nonwovens (or similar nonwovens thereto) as suitable, logical options for side flaps 34 and film-nonwoven backsheet 30, respectively, of the Benning-Karami '626 diaper. Benning and Karami '626 each disclose spunbond nonwovens as preferable for the side flaps/wings, and Karami '626—which discloses that its side flaps and wings can comprise the same nonwoven type (even if having a different basis weight)—teaches that a spunbond nonwoven is preferable for the backsheet outer cover. *See* Karami '626 at ¶¶ [0062]-[0065]; Benning at ¶ [0032]. Furthermore, Benning and Karami '626 each indicate that a side flap basis weight of 30 gsm is preferable, and Karami '626 teaches that a backsheet nonwoven basis weight of 20 gsm is “optimal”; as explained above in Section VII.B.3, it would have been obvious to use the combination of 30 gsm nonwoven wings and a 20 gsm backsheet nonwoven in the Benning-Karami '626 diaper (as Karami '626 suggests) to achieve a desired balance between softness and strength. *See* Karami '626 at ¶ [0065] (“20-40 gsm (optimally 34 gsm) are preferred for use on the wings” and “15-30 gsm (optimally 20 gsm) are preferred for the backsheet”); Benning at ¶ [0032] (“The material sections advantageously have a surface weight ... [that]

specifically [is] 25-50 g/m².”). Polypropylene would have been a logical option for the side flap and backsheet nonwovens of the Benning-Karami ’626 diaper, as it was a material known to work for a spunbond nonwoven designed to engage with the same Material Z fastener. *See* Karami ’772 at ¶¶ [0028], [0031] (using polypropylene for a 5-45 gsm spunbond nonwoven) and [0041] (using the same Binder 25445 fastener).

126. The fiber thickness of 2 dtex and embossing area of 21.13% also would have been logical selections for the nonwovens of the Benning-Karami ’626 diaper side flaps and backsheet. Karami ’626 teaches that for both its backsheet and wings, the preferred nonwoven includes “fibers hav[ing] an average size of 1.3 to 3.0 denier [1.44-3.33 dtex]⁴,” indicating a 2 dtex fiber thickness would have been an obvious and preferred choice. *See* Karami ’626 at ¶ [0063]. Additionally, Karami ’626’s preferred wing and backsheet nonwovens are embossed “by a thermal technique

⁴ Karami ’626 at ¶ [0063]. Denier and dtex are both measurements linear density with dtex measured in grams per 10,000 meters and denier is measured in grams per 9,000 meters. Hari at 1.7.1 and TABLE 1.5. The formula $\text{dtex} = \text{denier} \times \left(\frac{10}{9}\right)$ can be used to convert between the two units with 1.3-3.0 denier equating to 1.44-3.33 dtex. *See* Hari at 1.7.1 and TABLE 1.5.

such as calendering to produce ... a percentage bonding area of about 15-30%.” Karami ’626 at ¶ [0062]. This further illustrates how an embossing area of 21.13% would have been logical—and preferred—for the side flap and backsheet nonwovens in the Benning-Karami ’626 diaper; such an embossing area would have, for example, mitigated the risk of fiber tearing while allowing enough unbonded fibers to be free for fastener engagement. *See* Stupperich at ¶¶ [0007]-[0010] and [0018] (describing the same, with an embossing area of “19 to 22%” being “particularly advantageous”).

127. With the same or similar fastening materials as those used in the Diaper Patents being obvious, preferred options for the Benning-Karami ’626 diaper, the retaining forces recited by the Diaper Patents would have been obvious results. For the backsheet, the over-abdomen retaining forces between the 20x25 mm Binder 25445 fastener and a 20 gsm polypropylene spunbond nonwoven laminated to a film and having a 21.13% bonding area and a fiber thickness of 2 dtex would have been around 48.6 N/25 mm, and at least within the broad ranges the Diaper Patents recite (20-57 N/25 mm and 25-50 N/25 mm). *See* ’788 Patent at 13:34-41 and 15:43-44 (retaining forces “essentially ensured” by the nonwoven basis weight). Furthermore, as explained in my Sections VII.G and VII.H below, it would have been obvious to subject the film-nonwoven laminate backsheet to a temperature treatment and ring-rolling as is the Diaper Patents’ Material Y film-nonwoven

laminate. While the effect of these treatments on the retaining forces would have been less significant than other nonwoven parameters (e.g., basis weight, which “essentially ensured” the Diaper Patents’ lower backsheet retaining forces of “at least 20 N/25 mm”)—rendering the treatments unnecessary to yield retaining forces within the Diaper Patents’ ranges—the obviousness of the treatments confirms that the recited retaining forces would have been an obvious result of such a material selection. *See* ’788 Patent at 13:34-41.

128. Furthermore, nonwovens that would have been obvious to use for the film-nonwoven laminate backsheet of the Benning-Karami ’626 diaper include those having different parameters than the Diaper Patents’ Material Y nonwoven. For example, as I explained in Section VII.C.3, a range of basis weights would have been obvious for the nonwoven of backsheet 30, such as any of those within Karami ’626’s disclosed 13-50 gsm (preferably 15-30 gsm) range. *See* Karami ’626 at ¶ [0065]. To illustrate, basis weights lower and higher than 20 gsm (e.g., 15 gsm and 25 gsm, respectively, or even as close as 18 and 22 gsm) would have been equally obvious for the backsheet nonwoven and yielded lower and higher, respectively, retaining forces than if the 20 gsm nonwoven was used. These equally-obvious nonwovens would have still yielded retaining forces within the Diapers Patents’ ranges, even if, for example, such nonwovens had different fiber thicknesses or embossing patterns than the Material Y nonwoven.

129. For the wings, the over-abdomen retaining forces between the 20x25 mm Binder 25445 fastener and a 30 gsm polypropylene spunbond nonwoven having a 21.13% bonding area and a fiber thickness of 2 dtex would have been around 65.3 N/25 mm, and at least within the broad ranges the Diaper Patents recite (58-90 N/25 mm and 60-80 N/25 mm). *See* '788 Patent at 13:34-41 and 15:41-42 (retaining forces “essentially ensured” by the nonwoven basis weight).

130. Additionally, similar to the backsheet nonwoven, nonwovens that would have been obvious to use for the side flaps of the Benning-Karami '626 diaper include those having different parameters than the Diaper Patents' Material X nonwoven. For example, as I explained in Section VII.C.3, a range of basis weights would have been obvious for the nonwoven of each side flap, such as basis weights within Benning's ranges (10-150 gsm, and “specifically 25-50 [gsm]”) or Karami '626's ranges (13-50 gsm, preferably 20-40 gsm). *See* Benning at ¶ [0032]; Karami '626 at ¶ [0065]. To illustrate, basis weights lower and higher than 30 gsm (e.g., 25 gsm and 35 gsm, respectively) would have been equally obvious for the side flaps and would have yielded lower and higher, respectively, retaining forces than if a 30 gsm nonwoven was used. These equally-obvious nonwovens would have still yielded retaining forces within the Diapers Patents' ranges, even if, for example, such nonwovens had different fiber thicknesses or embossing patterns than the Material X nonwoven.

131. Even including adhesive on the fastener in addition to the 20x25 mm Binder 25445 hooks as I explain in further detail below in Section VII.E, over-abdomen retaining forces (shear strengths) still would have remained within the Diaper Patents' ranges at both the backsheet and at the wings with the above-described obvious material selections, particularly because adhesive material has a small impact on shear strength when engaged with a nonwoven. *See* my paragraph 102; Neugebauer at ¶¶ [0013], [0015]-[0017], and [0022].

D. Stupperich

132. Stupperich describes a nonwoven material that, like in Karami '626, can be used in a diaper and with which a hook fastener can securely engage to maintain the diaper in a closed configuration. *See* Stupperich at Abstract, ¶¶ [0001] and [0034]-[0035]; Karami '626 at ¶ [0070] (“[T]he preferred fastener element of the present invention is preferred for use only with conventional nonwovens.”). Furthermore, Stupperich utilizes the same Binder 42-288-HX200-PP3 fastener as preferred by Karami '626. Stupperich at ¶¶ [0019], [0023], [0034]; Karami '626 at ¶ [0060].

133. Per Stupperich, there are competing considerations for nonwoven materials with which hook fasteners engage: they are produced to have a good closing action based on engagement or hooking of the cooperating closure elements and cannot be accidentally released but should be releasable when desired, i.e.

without separating or tearing the materials of the closure elements. Stupperich at ¶¶ [0002] and [0007]. To mitigate tearing when a hook fastener is released, a portion of a nonwoven's fibers can be "solidifi[ed] or bonded," similar to that described in Karami '626. Stupperich at ¶ [0002]; Karami '626 at ¶¶ [0062]-[0063]. The drawback from bonding fibers is that bonded fibers are unavailable for engagement with a hook fastener, which results in "a decrease in the adhesive force of the mechanical closure system." Stupperich at ¶ [0002]. Stupperich seeks to balance these design considerations with its bonding pattern, illustrated below. Stupperich at ¶¶ [0007]-[0011] and FIG. 3A.

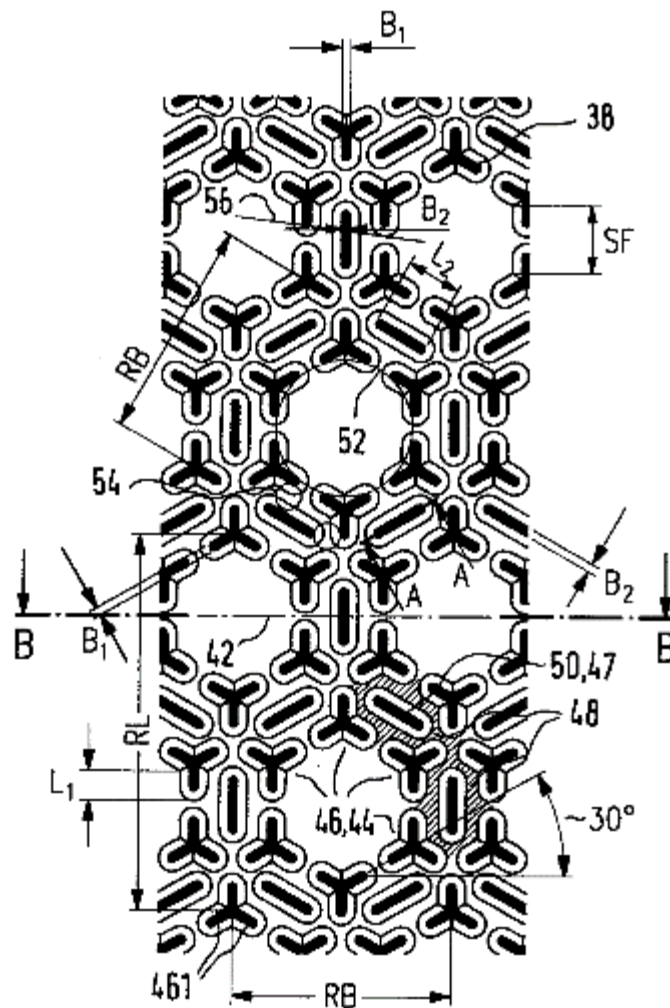


Fig. 3a

134. Stupperich's nonwoven is preferably a spunbonded or carded web material—or a laminate of a spunbond nonwoven and a carded nonwoven—that is engageable with a hook fastener, has a basis weight of 15-120 gsm (with the nonwoven layer defining the hook-engageable side having a basis weight of 10-60 gsm, preferably 20 to 35 gsm) and is bonded. Stupperich at ¶¶ [0019], [0021], and [0022]. Stupperich's nonwovens are breathable and liquid permeable. See

Stupperich at ¶ [0026] (“the nonwoven material is breathable, i.e. it allows water to pass through and/or is permeable to air”).

135. The nonwoven is bonded through “thermo embossing” such that its engagement surface includes “first larger nonbonded areas 42” surrounded by bonded “first segments 46” that are trilobal and “second [smaller] nonbonded areas 48” that surround bonded “second segments 47” that “are formed like bars.” Stupperich at ¶¶ [0007]-[0010], [0019], and [0062] and FIG. 3A. Large nonbonded areas 42 provide a sufficiently large anchoring area for the hook-forming component of the mechanical closure element, while smaller nonbonded areas 48 facilitate “a mechanical connection that is as continuous as possible.” Stupperich at ¶¶ [0008]-[0009]. Similar to Karami ’626, “10 to 60%” (“preferentially 19 to 22%”) of Stupperich’s nonwoven’s surface is bonded. Stupperich at ¶¶ [0067]; Karami ’626 at ¶ [0062] (“percentage bonding area of about 15-30%”). Stupperich discloses two specific examples of its nonwoven material, each having a carded web layer defining the hook-engageable surface and a spunbonded layer as a carrier: in the first example, the basis weight of the carrier nonwoven was 30 gsm, and in the second example the basis weight of the carrier nonwoven was 45 gsm. Stupperich at ¶¶ [0060]-[0064] and [0067]. A POSITA would have understood these specific examples, as nonwoven materials with an open, fibrous structure, are breathable and

liquid permeable. *See* Stupperich at ¶ [0026]; Karami '772 at ¶ [0028] (“Nonwoven materials ... readily allow the passage of liquids.”).

1. It Would Have Been Obvious to Use Stupperich's Bonded Nonwoven in Benning's Side Flaps and Backsheet

136. As a POSITA would have sought a nonwoven that is engageable with a hook fastener as Karami '626 calls for, Stupperich's nonwoven material would have been a suitable option for the wings of the Benning-Karami '626 diaper, particularly because Stupperich discloses that its nonwoven can suitably engage with Karami '626's preferred hook fastener. Stupperich at ¶¶ [0037], [0046], [0065], and [0068] (“‘Microplast' 42-288-HX200-PP3 from G. Binder GmbH”); Karami '626 at ¶¶ [0060] and [0070].

137. Additionally, Karami '626 would have invited a POSITA to use embossed nonwovens for both the backsheet and side flaps of the Benning-Karami '626 diaper, and a POSITA would have viewed Stupperich's nonwovens as attractive options because the Stupperich embossing pattern balances closing reliability and durability. Karami '626 at ¶ [0062] (fibers may be bonded by a variety of well-known means including thermal bonding); Stupperich at ¶¶ [0002], [0007]-[0010]. This balance would have been beneficial for both the backsheet and side flaps, as both would have been designed to engage with hook fasteners for size adjustability. *See* Section VII.C.2; Karami '626 at ¶¶ [0039]-[0040], [0055], [0062], and [0078].

138. As I explained in Section VII.C.3, it would have been obvious to use a higher basis weight nonwoven for the Benning-Karami '626 diaper's side flaps than for its backsheet, and a POSITA would have done the same when using Stupperich's nonwovens in those components.

139. A straightforward option for a POSITA would have been the two example nonwovens Stupperich details: the lower basis weight nonwoven with the 30 gsm carrier web (Stupperich at ¶¶ [0060]-[0064]) and the higher basis weight nonwoven with the 45 gsm carrier web (Stupperich at ¶ [0067]). Doing so would have promoted side flap strength and yielded higher retaining forces between the fasteners and side flaps; because higher retaining forces would have been preferable for securing the diaper around larger-waisted wearers and larger-waisted wearers would have positioned the fasteners on the side flaps, the higher retaining forces would have been advantageous. *See* Kleinschmidt at 2:19-32 (strength increases with basis weight); Young at 1:31-39 (same); Horn at ¶ [0006] (more loop anchoring yields higher retaining forces, which would have been provided by the higher basis weight); *compare* Stupperich at ¶¶ [0065] and [0068] (the higher basis weight nonwoven yielded higher shear strengths—58.89 N/25 mm—than the lower basis weight nonwoven's 51.00 N/25 mm). Meanwhile, the lower basis weight nonwoven would have reduced costs while still allowing the Benning-Karami '626 diaper's backsheet to enjoy the retaining force-durability benefits Stupperich's embossing

pattern provides. *See* Young at 6:40-41 (cost increases with basis weight). Additionally, this configuration would have maintained the simplicity of using similar nonwovens for the backsheet and wings, but with different basis weights, as suggested by Karami '626. *See* Karami '626 at ¶¶ [0062]-[0065].

140. A POSITA would not have been limited to Stupperich's specific example nonwovens, however. For example, Stupperich indicates its nonwovens can have different basis weights, such as 10-100 gsm (preferably 15-60 gsm) for the carrier layer and 10-60 gsm (in particular 10-40 gsm) for the hook-engaging-surface layer. Stupperich at ¶¶ [0021]-[0022] and [0025]. With that indication, a POSITA would have viewed it equally obvious to use a lower basis weight nonwoven for the Benning-Karami '626 backsheet than Stupperich's ¶ [0060]-[0064] example nonwoven (e.g., with a lower basis weight carrier layer and/or lower basis weight surface layer, such as to achieve further benefits of a reduced basis weight backsheet) and/or a higher basis weight nonwoven for the Benning-Karami '626 side flaps than Stupperich's ¶ [0067] example nonwoven (e.g., with a higher basis weight carrier layer and/or higher basis weight surface layer, such as to achieve further benefits of higher basis weight wings). Other retaining-force-affecting parameters a POSITA would have viewed as equally obvious include bonded area. *See* Stupperich at ¶¶ [0018], [0060], and [0067] (10-60% is preferable, compared to 19% and 17.1% for the lower-basis-weight and higher-basis-weight examples, respectively). With

these choices, obvious options would have included those yielding lower shear strengths at the backsheet than the lower-basis-weight example nonwoven's 51.00 N/25 mm (*see* Stupperich at ¶ [0065]) and higher shear strengths at the higher-basis-weight example nonwoven's 58.89 N/25 mm (*see* Stupperich at ¶ [0068]). Stupperich indicates the shear strengths its nonwovens can yield range from 5 to 80 N/25 mm, and obvious nonwoven choices for the backsheet would have included those yielding shear strengths that are even just slightly lower than 51.00 N/25 mm, such as within 25-50 N/25 mm (e.g., at least 40 N/25 mm). *See* Stupperich at ¶ [0034] and claims 30 and 32. Similarly, obvious nonwoven choices for the side flaps would have included those yielding shear strengths that are even just slightly higher than 58.89 N/25 mm, such as within 60-80 N/25 mm (e.g., at most 70 N/25 mm). *See* Stupperich at ¶ [0034] and claims 30 and 32. These choices yielding retaining forces within such ranges would have been obvious even with fastener changes. For example, as I explain below in Section VII.E, it would have been obvious to include an adhesive in addition to the hooks. Such additional adhesive would have had a marginal effect on shear strength (*see* my paragraphs 102 and 131) when engaged with a nonwoven and thus would not have taken Stupperich examples nonwovens' 51.00 N/25 mm and 58.89 N/25 mm shear strengths outside of the Diaper Patents' 20-57 N/25 mm and 58-90 N/25 mm ranges, respectively, particularly because it need only hold the fastener against the surface during

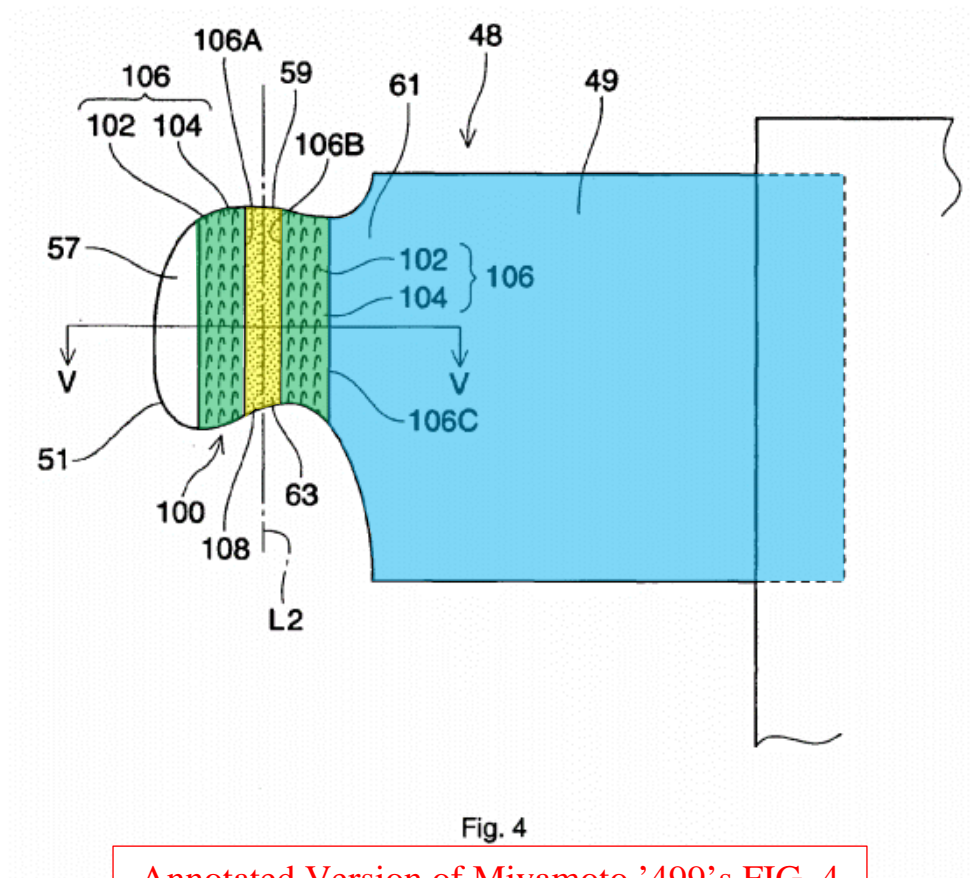
manufacturing/folding and its adherence is reduced after being peeled away to secure the diaper on a wearer. The use of such hook-and-adhesive fasteners further would not have altered Stupperich's target shear strengths (*see* Stupperich at ¶ [0034] and claims 30 and 32); accordingly, the obvious, routine selections of Stupperich's nonwovens yielding shear strengths of 25-50 N/25 mm and 60-80 N/25 mm at the backsheet and side flaps, respectively, of the Benning-Karami '626 diaper still would have been obvious, particularly because of the marginal effect of the adhesive on shear strength.

141. Such a modification would have been straightforward and routine for a POSITA and predictably yielded the balanced closing reliability and durability.

E. Miyamoto '499

142. Miyamoto '499 describes a fastening material 100 positioned on the end of nonwoven ear panels 49 [blue] "to provide a secure side closure for the diaper 20." Miyamoto '499 at ¶¶ [0031] and [0033]-[0034] and FIGs. 1, 4 (annotated below), and 5. Fastening material 100 includes a first fastening material 106 [green] and a second fastening material 108 [yellow], where the first fastening material has hooks 102 and the second fastening material comprises adhesive. Miyamoto '499 at ¶¶ [0033]-[0034]. Hook material 106 "engage[s] into the landing zone member 94" at the diaper's "front waist region 36" to "provide a secure side closure for the diaper 20." Miyamoto '499 at ¶¶ [0023] and [0033] and FIG. 3. Adhesive

material 108 “provides a supplemental fastening means” to the hook fastener and “serve[s] as a means to temporarily attach the shaped tab 51 to the ear panel 49 as shown in FIG. 1 before use of the diaper 20.” Miyamoto ’499 at ¶ [0034].



Annotated Version of Miyamoto '499's FIG. 4
("Annotated12")

1. It Would Have Been Obvious to Include an Adhesive Closure Aid in Addition to Hook Material on Diaper Fasteners

143. It would have been obvious to use diaper fasteners having an adhesive closure aid in addition to hook fastening material as in Miyamoto '499. *See* Miyamoto '499 at ¶¶ [0033]-[0034] and FIG. 4. A POSITA would have used adhesive material in addition to the hook fasteners 150a-150d of the modified

version of Karami '772's diaper (as I described in Section VII.B) and in addition to the mechanical closures 42 of the modified version of Benning's diaper (as I described in Section VII.C).

144. A POSITA would have done so to maintain the fasteners in a folded configuration in which the fasteners are folded onto the rear wings or side panels to which they are attached as Benning teaches for its closures 42 (*see* Benning at ¶ [0055] and FIG. 4) and which would have been obvious for Karami '772's fasteners 150a-150d (e.g., to facilitate folding of the wings and to mitigate the risk of the fasteners sustaining damage and/or unintentionally engaging with objects). Miyamoto '499 at ¶ [0034] (using adhesive 108 to do the same).

145. As a POSITA would have understood, adhesive tapes have less aggressive engagement with nonwovens than hook fasteners do and their inclusion in the fasteners would have provided a portion thereof suitable for maintaining the fasteners in the folded configuration and that could be detached while mitigating the risk of damage to the nonwoven.

146. Moreover, a POSITA would have understood that incorporating an adhesive fastening material in the fasteners of Karami '772 and Benning would have supplemented the retaining forces provided by the hooks, which would have assisted hook material in fastening to the outer surface of the diaper. *See* Miyamoto '499 at

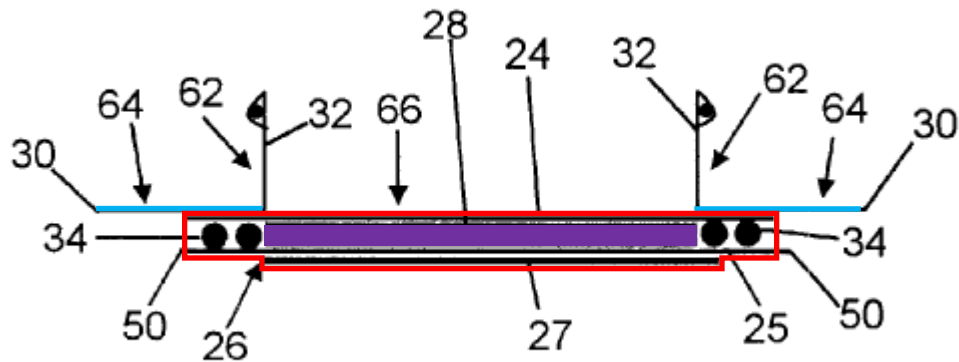
¶ [0034] (“The second adhesive material 108 provides a supplemental fastening means.”); Neugebauer at ¶¶ [0019], [0021], and [0027].

147. Such a modification of Karami ’772’s diaper 100 and Benning’s diaper would have been straightforward and routine for a POSITA, who would have been familiar with hook and adhesive diaper fasteners, and would have predictably achieved these benefits.

F. Kleinschmidt

148. As annotated below in annotated versions of Kleinschmidt’s FIGs. 1 and 2 and as I explained in Section V.A, Kleinschmidt describes a diaper 20 having a chassis 22 [red outline] that includes “a liquid pervious topsheet 24 and/or a liquid impervious backsheet 26 and at least a portion of an absorbent core 28 [purple] encased between the topsheet 24 and the backsheet 26.” Kleinschmidt at 4:19-24 and FIGs. 1-2. Diaper 20 also includes rear and front ear panels 30 [blue] with fasteners 40 [green] attached to the rear panels. Kleinschmidt at 6:48, 6:59-64, 7:11-21, and FIG. 1. Along each edge of chassis 22, diaper 20 includes “a single nonwoven ply” that extends longitudinally between front and rear waist regions 36 and 38 of the chassis and defines one of leg cuffs 32—“which provide improved containment of liquids and other body exudates”—one of front panels 30, and one of rear panels 30 such that the leg cuff and panels are “integrally formed.” Kleinschmidt at 6:7-15, 7:64-8:5, and FIGs. 1 and 2. Per Kleinschmidt, this single-

ply configuration “is less bulking and potentially lighter in weight,” addressing shortcomings in prior designs where separate cuffs “increase[d] the bulk of the chassis and may result in a product that is noisy to use.” Kleinschmidt at 1:40-55, 2:19-20, and 8:5-10. In crotch region 37, each of the two side parts defining front and rear ear panels 30 is narrowed. Kleinschmidt at FIG. 1.



Annotated Version of Kleinschmidt's FIG. 2
("Annotated2")

1. *It Would Have Been Obvious to Use Two Discrete Side Parts Connected to Opposing Chassis Edges and Extending Longitudinally Between the Front and Rear Thereof*

149. It would have been obvious to use two separate side parts defining a diaper's wings, with each side part attached to a respective edge of the chassis and extending continuously from the front of the chassis, through the crotch region, and to the rear of the chassis as in Kleinschmidt. *See* Kleinschmidt at FIGs. 1-2. Additionally, as in Kleinschmidt and Karami '772, it would have been obvious for each of the side parts to narrow in the crotch area. *See* Kleinschmidt at FIGs. 1-2; Karami '772 at ¶ [0046] and FIG. 6 ("diaper 100 has an 'hourglass' configuration"). A POSITA would have used this side part arrangement to define wings 131-134 of the modified version of Karami '772's diaper (as I described in Section VII.B) and to define side flaps 34 of the modified version of Benning's diaper (as I described in Section VII.C).

150. Using the two separate side parts would have yielded the benefits I described above in Section VII.B.1 (e.g., facilitating the use of different materials for the wings and chassis and manufacturability, such as through the use of narrower machines). A POSITA would have further understood that using wings with a narrower crotch region would allow the diaper to better conform to a wearer's legs to mitigate leakage and promote comfort. *See, e.g.,* Roe at ¶ [0140] and FIG. 20 (“The hourglass shape has a leg cutout in the crotch region of the diaper to provide fit about the legs.”). Additionally, with the wing material extending across the chassis' edge in the crotch region, more bonding area would have been provided to yield a stronger attachment to the chassis.

151. Furthermore, using the two separate side parts would have been a cost-efficient way to include leg cuffs (e.g., by making the leg cuffs integral with the side parts) as Kleinschmidt teaches. Kleinschmidt at 7:64-8:10. Integral panel and cuff side parts can be attached to the chassis to provide leak protection that is less bulky and at a reduced cost as compared to non-integral cuffs. Kleinschmidt at 8:64-66, 6:7-9, 1:30-44 (cuffs “inhibit[] loose fecal material or gushes of urine or liquids from soiling the wearer's clothing”) and 7:64-8:10, 1:45-56 (non-integral cuffs increase “bulk,” are “noisy in use,” and “cost[ly]”). A POSITA would recognize the advantages of using full length side parts—extending continuously from the rear waist region to the front waist region and narrowing in the crotch region—with

integrated cuffs to provide necessary leak protection at a reduced cost, and without sacrificing wearer comfort.

152. Modifying Karami '772's diaper 100 and Benning's diaper to use two discrete side parts would have been straightforward and routine for a POSITA and predictably yielded these benefits.

G. Jacobs

153. Jacobs describes "a process for producing a three dimensionally texturized liquid resistant laminate having a fibrous nonwoven layer and a liquid resistant layer" which is usable as a "diaper outer cover" (i.e., backsheet). Jacobs at Abstract and 9:32-43. As Jacobs recognizes, diaper backsheet desirably had "a cloth-like texture on the outside of the film layer" of the backsheet, which was typically achieved by constructing the backsheet of a film-nonwoven laminate. Jacobs at 1:10-33. Additionally, Jacobs recognizes that films in such laminates "may not be thermally stable," meaning that they "tend to shrink and deform when exposed to a temperature above the softening temperature of the polymer or polymers forming the composite." Jacobs at 1:34-44. Jacobs seeks to "further improv[es] tactile properties and thermal stability" of such laminates with its process. Jacobs at 1:45-46 and 3:7-15 ("The laminate provides highly desirable properties including improved loft, softness, cloth-like texture and pleasing gathered appearance" and "is heat stabilized").

154. In Jacobs's process—shown in its FIG. 1 (below)—film 12 is heated with rollers 14 and 16 to a “stretching temperature” and is then passed around rollers 20 and 22 that rotate at different speeds to stretch the film. Jacobs at 4:9-39. The “stretching temperature” is between the film's “glass transition temperature T_g and [] melting point T_m ,” which for Jacobs' ethylene polymer (i.e., polyethylene, as used in the backsheets of Karami '772's diaper and the modified Benning diaper) or propylene polymer (i.e., polypropylene) film is “between about 60° C. and about 120° C.” Jacobs at 4:12-22. The stretching “improve[s the] strength properties of the material” and “down gauge[s]” the film to improve its breathability and render it more economical. Jacobs at 3:46-56.

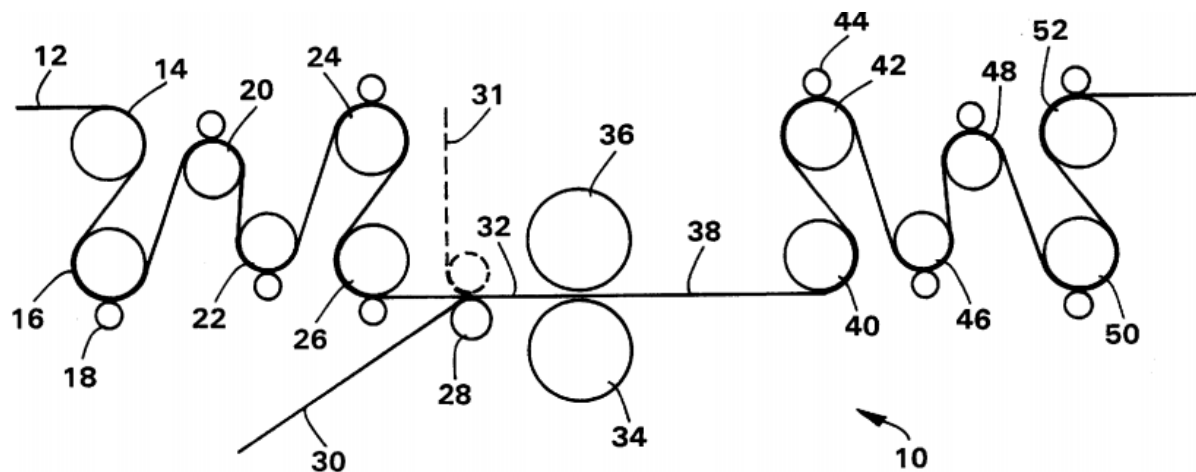


FIG. 1

155. After being stretched, film 12 is cooled “below the softening temperature of the film, by passing it over chill rollers or chill stack rollers 24 and 26” and is subsequently bonded to a nonwoven 30 at “spaced-apart bond sites” with

pattern roll 34 and anvil roll 36. Jacobs at 3:16-20 and 4:50-5:6. Due to the stretching of film 12, the film “exhibits a higher level of latent shrinkability than the fibrous [nonwoven] layer.” Jacobs at 3:44-48 and 4:9-12. Bonded laminate 38 is annealed to “activate[] the latent shrinkability” of the film. Jacobs at 1:54-66 and 5:24-30. To do so, “laminate 38 is passed over a series of heated rollers, e.g., 40 and 42” to heat the laminate to an “annealing temperature” that is “equal to or higher than the [] stretching temperature”—e.g., greater than or equal to 60° C to 120 C—but below the melting point T_m of the polymer that forms” the film. Jacobs at 4:18-22 and 5:25-30. Per Jacobs, it is “highly desirable” for the annealing temperature to be “between 5°C. and about 30 C. higher than the stretching temperature,” e.g., between 65° C and 150° C. Jacobs at 4:19-22 and 5:31-38. After passing around heated rollers 40 and 42, laminate 38 is passed through roller sets 46 and 48 at a slower rate than when passing through rollers 40 and 42 such that “the heated film layer of the laminate shrinks and thermally anneals.” Jacobs at 5:48-63.

156. From the annealing, “the shrinkage of the film layer causes the fibrous layer, which has a lower latent shrinkage than the film layer, to gather and bulk up between adjacent bond sites, forming a three dimensionally texturized laminate and improving textural properties of the laminate” as Jacobs illustrates in FIG. 2 (below). Jacobs at 6:6-11 and 6:30-38. Per Jacobs, this gathered laminate “exhibits highly desirable textural and visual properties” (e.g., “soft, drapable, lofty characteristics”

that help achieve a “cloth-like texture”) and is “thermally stable” up to the annealing temperature, which renders the film amenable to printing. Jacobs at 2:66-3:15, 5:38-40, 6:23-26, and 9:32-40; Tao at 1:37-50 and 4:62-5:14.

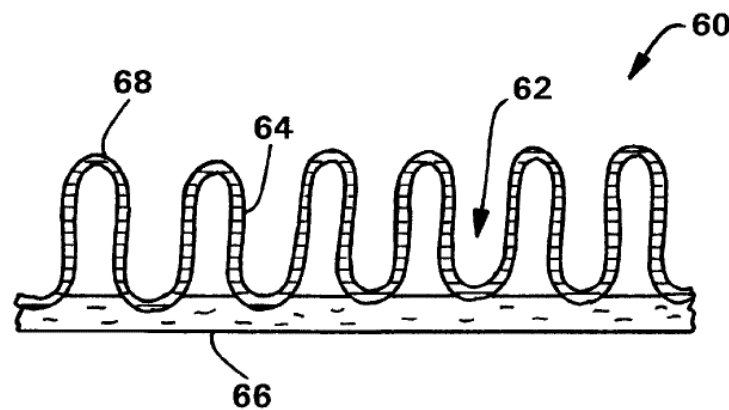


FIG. 2

1. It Would Have Been Obvious to Use a Temperature Treatment for a Film-Nonwoven Laminate Backsheet

157. It would have been obvious to make the film-nonwoven backsheet of a diaper using Jacobs’s process as I described above in paragraphs 153-156. A POSITA would have used this process to make the film-nonwoven laminate backsheet 130 of the modified version of Karami ’772’s diaper (as I described in Section VII.B) and the film-nonwoven laminate underlayer/backsheet 30 of the modified version of Benning’s diaper (as I described in Section VII.C). As part of that process, a POSITA would have annealed the film-nonwoven laminate (i.e., subjected it to a temperature treatment) in which the laminate is heated to a

temperature that is at least 60° C as Jacobs teaches. *See* Karami '772 at ¶ [0052] (using polypropylene or polyethylene film); Karami '626 at ¶[0064] (using polypropylene or polyethylene film, which was common and a POSITA would have used in the modified Benning diaper); Jacobs at 4:18-22 and 5:25-38 (annealing temperature is at least 60-120° C for polypropylene or polyethylene film). A POSITA would have done so to achieve the benefits Jacobs describes, i.e., improved cloth-like texture for the backsheet and thermal stability. *See* Jacobs at 2:66-3:15, 5:38-40, 6:23-26, and 9:32-40; Tao at 1:37-50 and 4:62-5:14.

158. As with the temperature treatment in the Diaper Patents, Jacobs's annealing causes the film to shrink such that the nonwoven gathers. Jacobs at 1:54-66 and 5:24-63 (using heated rollers 40, 42 followed by slower-moving rollers 46, 48 to cause film shrinkage); '788 Patent at 8:8-28 and 9:16-33 (temperature treatment "is preferably performed by heating the nonwoven-foil laminate by means of one or more hot rollers" after which the laminate "passes directly to slow-running cooling rollers" to cause film shrinkage). This would at least marginally increase the "over-abdomen retaining forces" (i.e., shear strength) between the hook fasteners and the backsheet's nonwoven as the Diaper Patents describe. '788 Patent at 8:17-23 ("The shrinkage of the foil forces the nonwoven component connected to gather, resulting in an increase in mass per unit area, so that the nonwoven component can subsequently better engage with the closure means having mechanical closure aids

and exhibit its higher over-abdomen retaining forces than before temperature-treatment.”).

159. Such a modification of the Karami '772-Benning diaper and the Benning-Karami '626 diaper would have been routine and straightforward for a POSITA, who would have been familiar with the well-known annealing process, and predictably achieved these benefits. *See* Jacobs at 1:34-44 (explaining how annealing was known).

H. Anderson

160. Anderson describes a process of “modifying the physical characteristics of a web”—such as a film-nonwoven laminate for use as a backsheet—such that it “has desirable breathability and liquid impermeability, as well as extensibility and a soft, cloth-like textured surface.” Anderson at Abstract and 3:8-17. As Anderson describes, the “backsheet, in addition to providing imperviousness to liquids, desirably permit[s] the passage therethrough of moisture vapor and also preferably air, to help maintain dryness and to reduce the humidity adjacent the wearer’s body.” Anderson at 1:28-34. One well-known way of achieving backsheet breathability and extensibility was through “ring-rolling” in which the film-nonwoven laminate was passed between “corrugating rolls” having inter-engaged teeth and grooves that “locally stretch and form corrugations in the material.” *See* Anderson at 2:1-31 and FIGs. 2-4 (showing ring rolls 8 and 9 having inter-engaged teeth 22 and grooves 24);

Brady at 1:49-56 (“To increase the water vapor transmission rate (‘WVTR’) of a film stretched by a ring-rolling process, it has been customary to increase either the filler loading in the formulation or the depth of engagement of the interdigitating grooves.”); McCormack at 1:42-58 (“When fillers are used, the film is often crushed between rollers to crack the filler or stretched so as to create small gaps between the polymer and the particles embedded in the polymer” which “creates a tortuous path from one surface of the film to the other and thus provides a path for the escape of water vapor”).

161. Anderson describes “an improved method” of treating a film-nonwoven laminate that includes ring-rolling and in which the film-nonwoven laminate “is passed between at least one pair of inter-engaged rolls” (i.e., ring-rolls) and, optionally, heated up to a temperature of “about 120° C” such that it is “breathable to air or vapor, but acts as a liquid barrier” and has “a soft, clothlike surface and extensibility for improved fit and wearer comfort.” Anderson at 2:51-3:23 and FIGs. 2-4 (showing ring-rolling). In Anderson’s process, nonwoven web 5 is joined to polymeric film 11 at joining station 13 “to provide a composite web 12 that can be utilized as backsheet for a disposable absorbent article, such as a disposable diaper.” Anderson at 17:46-58, 17:65-18:2, 18:14-51 (describing various techniques of joining the nonwoven and film) and FIG. 9 (below).

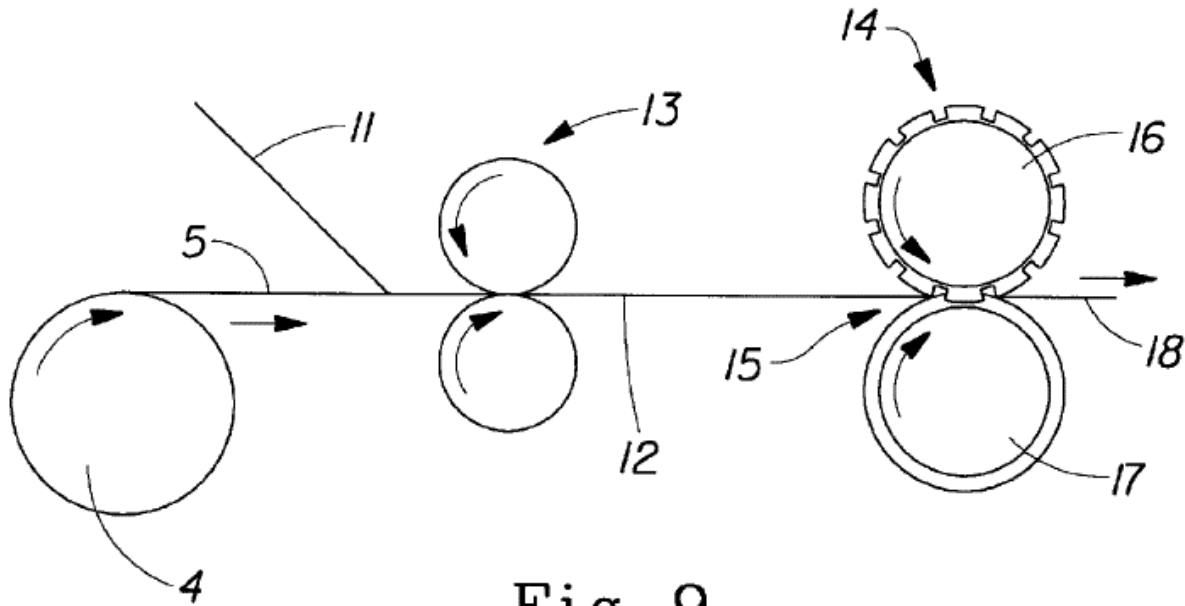


Fig. 9

162. Joining is “[p]referably” performed “before the film is made breathable” as, per Anderson, modifying the film while joined with the nonwoven “allows the properties of the nonwoven web to be modified as desired without simultaneously undesirably effecting the structural integrity of the film and/or the composite.” Anderson at 18:5-13. Composite web 12 is modified by “pass[ing it] between a pair of opposed, inter-engaging forming rollers 16, 17 at modification station 14” which can be any of the forming rolls Anderson describes throughout. *See* Anderson at 18:52-56 and FIG. 9. Anderson depicts illustrative forming rolls 8, 9 in its FIG. 2 (below): they include teeth 22 and grooves 24 that are inter-engaged such that the teeth of each of the rollers “extend partially into generally triangular

grooves 24 of the opposed roll.” Anderson at 5:49-6:17 and FIGs. 2-3. A POSITA would have understood that this process is ring-rolling.

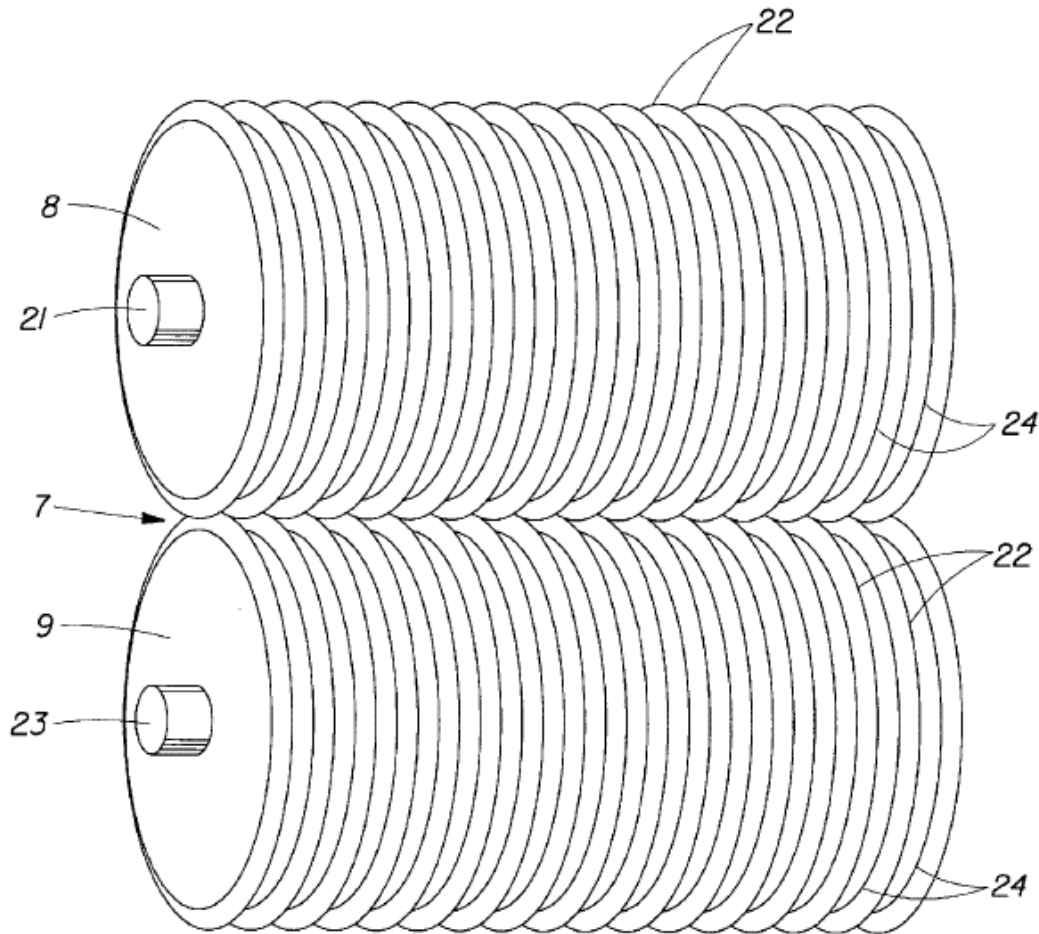


Fig. 2

163. As a result, portions of the material (e.g., film-nonwoven laminate) are “pressed by teeth 22 into opposed grooves 24” which imposes “tensile stresses that act in the cross-web direction [(i.e., the direction perpendicular to that in which the laminate is moving)]” that stretch “intermediate web sections 26” between adjacent teeth 22. Anderson at 6:18-34 and FIG. 4 (below). This selective stretching causes

the material to stretch between the apexes of each of the rings such that it includes “alternating peaks 30 and valleys 32, which define alternating heavy and light basis weight regions,” paralleling a “corduroying” effect. Anderson at 6:65-7:25 and FIG. 5; *see also* Anderson at FIGs. 7-8 and 10-11 (showing different peak and valley patterns yielded by different roller geometries). Anderson teaches that these modifications can improve “the performance characteristics” of the nonwoven-film laminate. Anderson at 10:64-11:11. For example, as modified “the cross-web extensibility of [the laminate] ... is substantially higher than that of an unmodified [laminate]” and requires less force to be stretched such that, when used with a diaper, the laminate “more easily [] conforms with and adapts to the contours of the body” to improve comfort. Anderson at 11:23-48. Additionally, with “a film containing pore-forming agents or incompatible fillers,” the stretching “impart[s] breathability to the modified film while imparting minimal adverse effect on the leakage performance of the modified web ... by forming micropores in the film” which are “sufficiently small in order to prevent the passage therethrough of liquids, but [] are large enough for the passage therethrough of air and moisture vapor.” Anderson at 12:12-22. Passing the laminate between the rollers after nonwoven 5 and film 11 are bonded “promote[s] ‘rapid nucleation’ mode of pore formation in the film component” for breathability. Anderson at 15:56-16:5 and 18:56-65.

1. It Would Have Been Obvious to Use Ring-Rolling for a Film-Nonwoven Laminate Backsheet

164. It would have been obvious to subject a film-nonwoven laminate of a backsheet to ring-rolling as taught by Anderson. *See* Anderson at 17:46-58 (modified film-nonwoven laminate “can be utilized as a backsheet for a disposable absorbent article, such as a disposable diaper”). A POSITA would have used ring-rolling for the film-nonwoven laminate backsheet 130 of the modified version of Karami ’772’s diaper (as I described in Section VII.B) and for the film-nonwoven laminate underlayer/backsheet 30 of the modified version of Benning’s diaper (as I described in Section VII.C). A POSITA would have done so to achieve the benefits Anderson describes as set forth above, such as to improve the backsheet extensibility to allow the diaper to “more easily [] conform[] with and adapt[] to the contours of the body” and “impart breathability to the modified film,” both of which promote wearer comfort. Anderson at 1:28-34, 2:41-44, 11:23-48, 12:12-22, 15:56-16:5, and 18:56-65.

165. Such a modification of the Karami ’772-Benning diaper and the Benning-Karami ’626 diaper would have been straightforward and routine for a POSITA, who as the Diaper Patents acknowledge would have been familiar with ring-rolling, and predictably achieved the breathability and extensibility that Anderson describes. *See* Anderson at 2:1-31; ’788 Patent at 8:3-7 (“by the known ring-rolling method”).

2. *It Would Have Been Obvious to Use a Breathable Film in the Backsheet of the Modified Benning Diaper in View of Anderson*

166. It would have been obvious to modify the film of the film-nonwoven underlayer of Benning's modified diaper (*see* Section VII.C) to be breathable, i.e., such that it is pervious to air and water vapor to promote wearer comfort. As Anderson describes, it was well-known that "a backsheet, in addition to providing imperviousness to liquids, desirably permit the passage therethrough of moisture vapor and also preferably air, to help maintain dryness and to reduce the humidity adjacent the wearer's body." Anderson at 1:28-34. Anderson's process is thus used to form a film-nonwoven laminate that "has good breathability (as manifested in moisture vapor transmission rate and air flow rate) while maintaining satisfactorily low leakage." Anderson at 2:64-3:7, 17:46-58, 18:2-10, 18:52-65, and 19:58-20:5. Such a modification would have been routine and straightforward for a POSITA, who would have been familiar with film-nonwoven backsheets that are breathable but liquid impermeable, and would have predictably achieved improved comfort as these ring-rolled microporous backsheet laminates had been commercially available since 1998 in Europe and shortly thereafter in North America in 1999.

I. Fernfors

167. Fernfors describes an absorbent article 1 with liquid-pervious topsheet 2, a liquid-impermeable backsheet 3, and an absorbent body enclosed therebetween. Fernfors at ¶ [0023]. The absorbent article 1 includes a front

portion 5 and a back portion 6 with two belt halves 9, 9' attached to the back portion and configured to engage with the front portion when the absorbent article is worn by a user. Fernfors at ¶ [0027]. The front portion 5 preferably includes hook members 8 intended to engage the outside of belt halves 9, 9' while one of the belt halves includes further hook members 15 to fasten the belt halves together. Fernfors at ¶¶ [0032]-[0033] and FIG. 1 (produced below). Each belt half can be made of any suitable material, such as spunbond polypropylene, that “is able to interact with the hook members of the fastening system.” Fernfors at ¶ [0034].

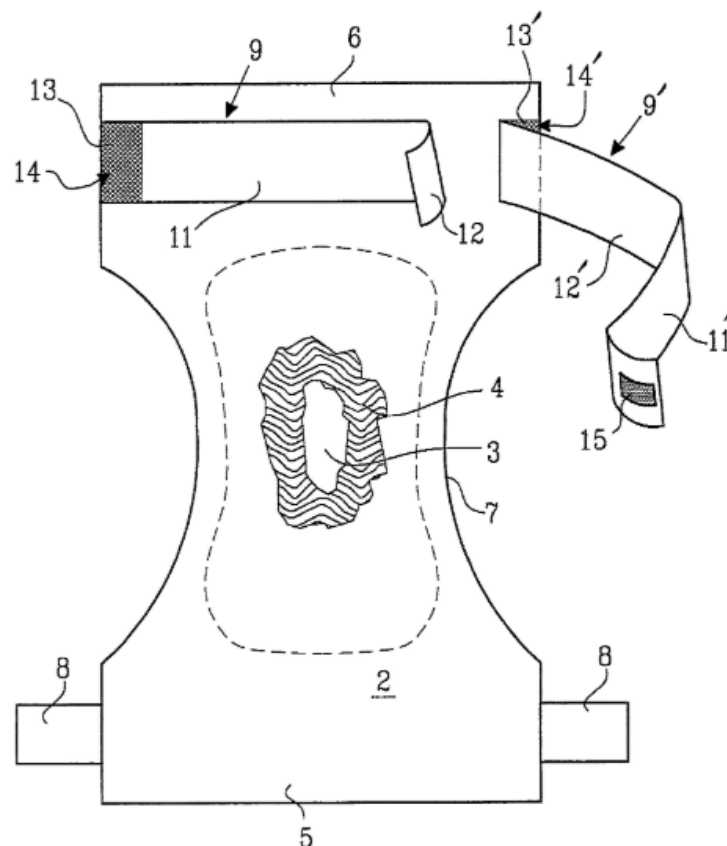


Fig. 1

168. Fernfors's belt can be attached to back portion 6 "by means of any suitable method." Fernfors at ¶ [0032]. One way Fernfors attaches the belt halves to the back portion is via "pieces of reinforcement material" that are permanently attached to the back portion at its opposite edges. Fernfors at ¶ [0045] and FIG. 6 (below, reinforcing pieces 323, 323'). A POSITA would have understood that materials such as a polymeric film or nonwoven material are suitable for use as a reinforcement material. *See* Huang at ¶¶ [0065] and [0117] (reinforcement member "may be composed of a polymer film, a nonwoven fabric, a woven fabric or the like"). Fernfors explains these pieces of reinforcement material 323, 323' "preferably ... extend outside the article width" and the topsheet to overlap both the topsheet and an end of the belt. Fernfors at ¶¶ [0030] and [0046]. Such reinforcement material extends only partially onto the belt and is narrower than the belt to deliver increased strength at the chassis-belt connection. Fernfors at ¶ [0046] and FIG. 6 (below).

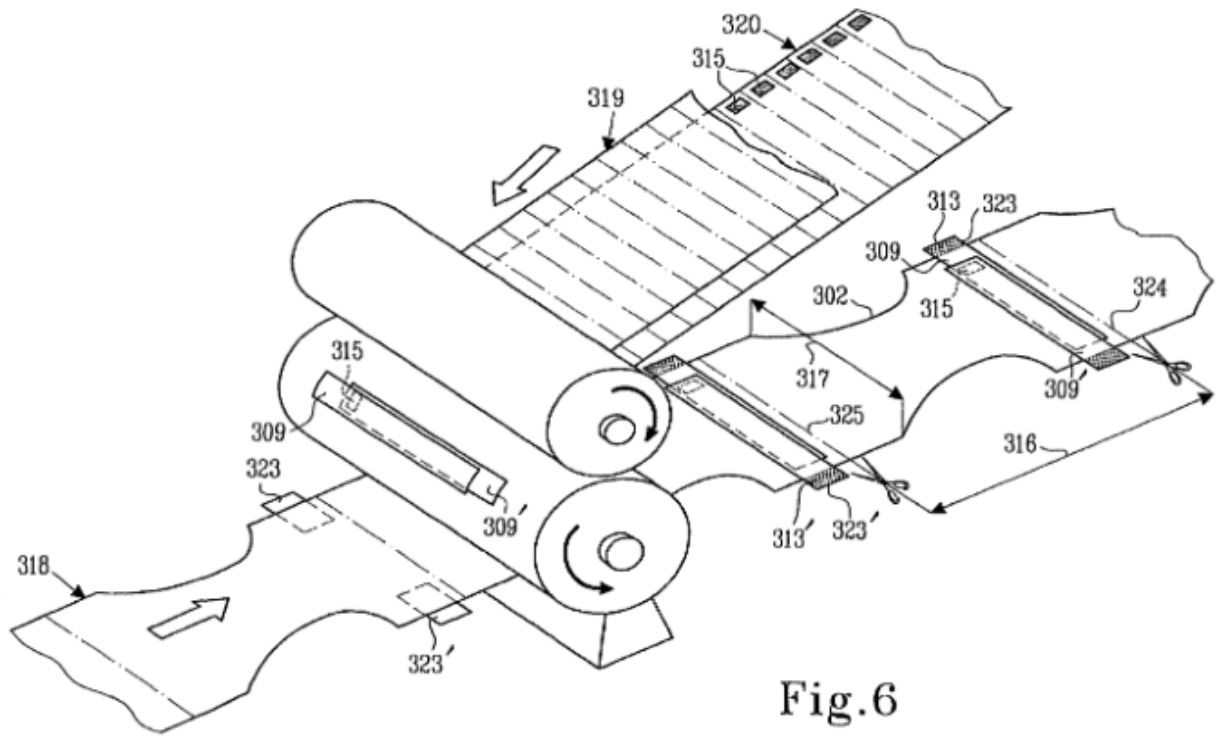


Fig.6

169. A POSITA would have understood that such reinforcement material 323, 323' placed at the interface between the belt halves and the back portion increases the strength of the connection therebetween. This is because diaper components at the chassis edge would have been subject to higher stresses (e.g., due at least in part to their narrower geometries) and thus susceptible to tearing without reinforcement. Huang confirms this: it utilizes stress beam sections 98, 99 “to accept the force imparted through side panel [] and distribute the force over a wider area of the chassis” and thus avoid undesirable stress concentrations that might tear or deform portions of the diaper at the interfaces between the wings—like Fernfors’s belt portions—and chassis. Huang at ¶¶ [0116]-[0119] and FIGs. 15-17.

1. *It Would Have Been Obvious to Use Reinforcement Material That Overlaps an Edge of the Chassis and a Portion of the Wing*

170. It would have been obvious to include a reinforcing material, such as a nonwoven or film, as in Fernfors to achieve stronger chassis-wings connections in both the Karami '772-Benning (Section VII.B) and Benning-Karami '626 (Section VII.C) diapers and thereby mitigate the above-described risk of tearing. A POSITA would have done so in the manner Fernfors teaches, with each reinforcement overlapping both the wing and the chassis' edge and being narrower than the wing such that it does extend to the free end thereof. *See* Fernfors at FIG. 6.

171. Such a modification would have been routine and straightforward to a POSITA, involving merely the incorporation of a reinforcing strip—being transversely narrower than the wings—at the wing-chassis interfaces of each of the Karami '772-Benning and Benning-Karami '626 diapers, to achieve stronger chassis-wings connections.

J. Differences in the '398 Patent, the '249 Patent, and the '990 Patent

1. *It Would Have Been Obvious to Use a Thicker Nonwoven for the Wings than for the Film-Nonwoven Laminate Backsheet*

172. As explained above, it would have been obvious to use a heavier basis weight nonwoven for the wings than for the film-nonwoven laminate backsheet in both the Karami '772-Benning diaper (*see* Section VII.B.3) and the Benning-Karami '626 diaper (*see* Section VII.C.3). One straightforward way of doing so would have been to use otherwise similar nonwovens, such as of the same type (e.g.,

spunbond), fiber material (e.g., polypropylene), fiber thickness, and the like. This is in part because a POSITA would have understood that the same nonwoven types would have been suitable for both the wings and backsheet. *See, e.g.*, Karami '772 at ¶¶ [0045]-[0046], [0048], and [0052]-[0053] (diaper 100's entire perimeter defined by the same polypropylene spunbond nonwoven of backsheet 130); Karami '626 at ¶¶ [0062]-[0065] (nonwovens for backsheet and wings are preferably the same except that "slightly higher basis weights ... are preferred for use on the wings"); Sun at 8:3-28 ("20 gsm ... spunbond polypropylene nonwoven web" is an example of a backsheet that "desirably ... provides a generally cloth-like texture"); Kleinschmidt at 8:11-38 ("polypropylene spunbond thermal point bonded nonwoven" for use in the ply whose high basis weight region defines side panel 30); Benning at ¶ [0032] (spunbond nonwoven preferable for side flaps). With the same nonwoven type used for the wings and backsheet, the benefits of using different basis weights that I described in Sections VII.B.3 and VII.C.3 would have been achieved in a simple, straightforward manner by using different thicknesses. *See, e.g.*, Kleinschmidt at 8:11-38 and 9:60-10:2 (using the same nonwoven having different basis weight regions to attain different characteristics for leg cuffs 32 and side panels 30).

173. The higher basis weight wing nonwoven, being of the same type as the lower basis weight backsheet nonwoven, would have been thicker than the backsheet

nonwoven because it would have included more material per unit area. *See, e.g.,* Chhabra at ¶¶ [0005]-[0006] (“Adding basis weight, or more material to the nonwoven substrate, increases the [] thickness of the nonwoven substrate.”); Kleinschmidt at 9:45-48 and 9:60-10:2 (one way to increase basis weight in a spunbond nonwoven, when using the same fibers, is to deposit “a higher density of filaments,” which makes a thicker web); Young at 5:6-24 (two factors determining basis weight include (1) “fiber density or fiber denier,” which would have been the same for nonwovens of the same type, and (2) “substrate speed,” with slower substrate speeds resulting in more fibers being deposited per unit area and thus yielding a higher thickness as alluded to in Kleinschmidt); *see also* ’788 Patent at 7:26-35 (the nonwoven side part nonwovens have a higher basis weight than the backsheet nonwoven and “therefore ha[ve] a greater thickness than the [backsheet nonwoven]”). This is so even when the thicknesses are measured with “a test pressure of 0.5 kPa” applied to the nonwovens as in the Diaper Patents (*see* ’788 Patent at 7:32-35), as under such pressure the thicker, heavier nonwoven with more material would have remained thicker than the thinner, lighter nonwoven that has less material.

174. Furthermore, independent of the obviousness of using the same nonwoven types for the wings and backsheet, depositing a thicker web of fibers was a known way to increase basis weight and would have been a straightforward, logical

option for producing a wing nonwoven that has a higher basis weight than the backsheet nonwoven. *See, e.g.*, Kleinschmidt at 9:60-10:2 (depositing more—and thus a thicker web of—fibers for the high basis weight region); Young at 5:6-24 (slower substrate speed to increase basis weight, meaning a thicker web of fibers is deposited).

175. Such a modification of the Karami '772-Benning and Benning-Karami '626 diaper would have been routine and straightforward for a POSITA, who would have been familiar with the relationship between thickness and basis weight, and would have predictably achieved a higher basis weight in the wings' nonwovens than in the backsheet's nonwoven.

2. *The Diaper Patents' Wing Dimensions Would Have Been Obvious*

176. The Diaper Patents disclose that their side parts, when unfolded, extend transversely past the chassis' side edges by “at least 10 cm” and “preferably no more than 35 cm,” with the '249 Patent and '990 Patent specifically giving a range of 15-35 cm. '788 Patent at 10:20-25; '249 Patent at claims 29 and 51; '990 Patent at claim 10. They also disclose that the longitudinal dimension of each side part (e.g., measured parallel to the chassis' side edges) is “at least 10 cm” and “in particular at least 14 cm.” '788 Patent at 10:25-30; '249 Patent at claims 30 and 52; '990 Patent at claim 11.

177. Benning discloses that its side flaps, when unfolded, can each transversely extend past its chassis' edges by the same amount as that disclosed in the Diaper Patents, including by between 15 and 35 cm. *See* Benning at ¶ [0029] (“The extension of a material section attached to the main body portion in the unfolded state in the transverse direction beyond the lengthwise edge of the main body ... measures at least 10 cm, specifically at least 15 cm ... [and] preferably measures 35 cm at the most.”). It also discloses that each side flaps' lengthwise dimensions can be the same as that disclosed in the Diapers Patents, including at least 14 cm. Benning at ¶ [0028] (“The width, or the extension of a material section in the lengthwise direction .. is preferably at least 10 cm in the area of the attachment to the main body portion, specifically at least 14 cm.”). These are side flap dimensions a POSITA would have maintained in the Benning-Karami '626 diaper.

178. Additionally, a POSITA would have understood the side flap dimensions disclosed in Benning (e.g., extending transversely past the chassis edge by 15-35 cm and at least 14 cm wide in the longitudinal direction) to be suitable for the Karami '772-Benning diaper. The appropriate wing size depended at least in part on the size of intended wearers, where for larger-waisted wearers the wings were desirably larger in both the transverse and longitudinal dimensions to wrap around and achieve adequate coverage of a wearer's hips for a good fit and comfort. A POSITA would have understood the Benning side flap dimensions to be

appropriate for wearers of at least some sizes—such as for adults—and thus would have used the same for the Karami ’772-Benning diaper wings. *See* Benning at ¶¶ [0002] and [0028]-[0029] (Benning’s “invention relates to an absorbent incontinence article, specifically for incontinent adults,” and its relatively large wing sizes are consistent with that purpose); Karami ’772 at ¶¶ [0026] and [0030] (Karami ’772’s diapers being intended for “incontinent person[s]”/adults confirms a POSITA would have viewed Benning’s side flap dimensions as logical options). Moreover, the Benning side flap dimensions would have been particularly relevant because, as with the Benning diaper, a POSITA would have logically constructed the Karami ’772-Benning diaper with four wings. *See* Section VII.B.1; Karami ’772 at ¶ [0047] and FIGs. 6 and 8 (diaper 100 has four wings 131-134); Benning at ¶¶ [0002], [0007], and [0028]-[0029] and FIG. 4 (noting that, compared to T-shaped diapers whose “belt ... is relatively narrow,” its diapers “have fairly wide lateral material sections”).

179. Selecting wing size would have been straightforward and routine for a POSITA, who would have been familiar with diaper sizing, and predictably yielded a diaper sized appropriately for the intended wearers.

3. *Thermal Embossing Would Have Been Obvious*

180. Karami ’772’s nonwovens are “bonded” nonwovens. *See, e.g.,* Karami ’772 at ¶¶ [0010]-[0014]. This includes the nonwoven of his backsheet 130,

along with its section that underlies containment assembly 120 and its sections that extend into wings 131-134. Karami '772 at ¶¶ [0046]-[0048] and [0052]; *see also* Karami '772 at ¶ [0010] (water jet treatments and/or aperturing are applied to “bonded nonwoven surface[s]”) and ¶ [0053] and FIG. 8 (“entire front waist portion”—including wing sections and parts of the containment-assembly section of the backsheet—“can be water jet treated and/or apertured”).

181. As Karami '772 explains, a “nonwoven can be bonded by thermal bonding” (Karami '772 at ¶ [0035] and claim 33), including “point bonding” (*see* Karami '772 at claims 33 and 38). Karami '772 details such a technique by incorporating U.S. Patent No. 6,537,644 (“Kauschke”) (Karami '772 at ¶ [0035]), which in turn describes a “thermobonding process ... to form bonding points 20 on [a] nonwoven ... to secure [its] fibers together” that involves passing the nonwoven “between a smooth heated roller and an engraved roll which includes the required bonding point shape and/or pattern” (Kauschke at 4:54-5:13, FIGs. 1-3 (showing resulting pattern of bonding points 20)).

182. Such a bonding point pattern is a thermal embossing pattern. This is confirmed by the Diaper Patents’ explanation that “a thermal embossing pattern is advantageously produced using calanders”—rollers like Kauschke’s—“with the input of thermal energy” to form “spot-like joining points or joining regions in a known fashion.” '788 Patent at 6:36-48.

183. Karami '626's wings and backsheet nonwovens are thermally-embossed too: "[p]referably the fibers are point bonded by a thermal technique such as calendering to produce a fuzzy nonwoven having a percentage bonding area of about 15-30%." Karami '626 at ¶¶ [0062]-[0065] (also referencing Kauschke).

184. A POSITA would have understood that such thermal embossing patterns increased a nonwoven's strength (*see* Kauschke at 1:56-2:5 (increasing bonding area increases strength)) as well as its resistance to tearing when used to engage with hook-type fasteners (Karami '626 at ¶ [0068] ("The number of fibers and the extent to which they are bonded together in the nonwoven provide the nonwoven with the strength necessary to provide a high level of shear strength."); Stupperich at ¶ [0002] (bonding mitigates tearing of a nonwoven used with hook-type fasteners)).

185. In order to achieve these benefits, it would have been obvious to thermally emboss the Karami '772-Benning diaper's (*see* Section VII.B) and the Benning-Karami '626-Benning diaper's (*see* Section VII.C) wing and backsheet nonwovens (e.g., at individual joining points) as Karami '772 and Karami '626 describe. Furthermore, bonding was typically necessary for nonwoven structural integrity and was a well-known technique consistent with the approach Karami '772 and Karami '626 already took with their backsheet and wing nonwovens. *See* Kauschke at 1:24-26 ("In a typical spunbond process, ... fabric then passes through

a bonding station. Bonding is necessary because the filaments or threads are not woven together.”), 1:56-2:5 (increasing bonding area increases strength). Such bonding thus would have been routine and straightforward for a POSITA and predictably yielded these benefits.

4. Claims Reciting Retaining Forces Measured Over a Curved Surface

186. Certain claims of the Diaper Patents recite aspects of the method used to measure their retaining forces. In particular, claim 30 of the '398 Patent and claims 13 and 41 of the '249 Patent recite that its retaining forces were “determined using a pull-off angle tangential to a curved surface and kept constant, said curved surface having a radius of curvature of 400 mm.” '398 Patent at claim 30; '249 Patent at claims 13 and 41. As I explained in my paragraph 57, the Diaper Patents' retaining forces are an indirect measurement of shear forces at fastener-nonwoven interfaces, and that measurement does not change the structures of those fasteners or nonwovens and thus does not meaningfully change the shear forces between them.

187. That neither the Karami '772-Benning nor the Benning-Karami '626 combinations disclose or suggest this measurement method is of no import because both combinations use materials that would, if tested that way, have yielded the claimed forces. *See* Sections VII.B.4 and VII.C.4. Furthermore, as noted above, the Diaper Patents' test method—and shear strengths within their ranges measured pursuant to that test method—was known. *Compare* Stupperich at ¶¶ [0036]-[0045]

and FIGs. 4 and 5A-5B *with* '788 Patent at 2:34-4:28 and FIGs. 8 and 9A-9B; *see also* Supperich at ¶ [0034] and claims 30 and 32.

XVII. CONCLUSION

188. All statements made herein of my own knowledge are true, all statements made herein on information and belief are believed to be true, and these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001.

Dated: August 17, 2020

A.D. JEZZI

Arrigo D. Jezzi

ATTACHMENT A

EXECUTIVE SUMMARY

Dynamic, results oriented, and hands-on executive with many years experience in the development and launch of consumer and industrial products. Proven success in business start ups. Extensive experience in R&D, global sourcing, and emerging market development. Demonstrated ability to manage across large complex organizations, to negotiate joint venture agreements and to integrate acquired companies.

SKILLED IN

Strategic Planning	Cost Management
Operations Management	Product Development
Profit and Loss Accountability	Intellectual Property Management
International Business Development	Materials and Process Development

CAREER SUMMARY

A.D. Jezzi & Associates, LLC –Bala Cynwyd, PA

PRINCIPAL

Management and Technical Consultant

Consulting in Management and Technology in the paper, non-woven and consumer products industries.

Developed and patented a new non-woven process for the manufacture of industrial and consumer wipes.

Developed two business propositions for the commercialization of two distinct and patented consumer products for the pet care and the beauty salon industry. Each with the potential of achieving \$25MM to \$50MM in sales.

Participated in fourteen patent litigation cases in the last eleven years.

Clopay Plastic Products Company- Cincinnati, OH

July, 2000 to October, 2006

VICE PRESIDENT GLOBAL TECHNOLOGY and G.M. OF ASIA PACIFIC & LATIN AMERICA

Responsible for technology and product development for printed microporous films, elastomeric films and non-woven and film laminate business for hygiene, industrial and medical fabrics applications for North America, Europe, Asia Pacific and South America.

Led team for recently formed joint venture in Brazil, and currently leading M&A activity for North American acquisition and joint venture in Asia Pacific. P&L responsibility for Clopay do Brazil.

Instrumental in moving Clopay from tactical supplier status to a strategic supplier status with Procter & Gamble, and key in establishing new customer base in the personal care absorbent products industry for the company.

Led development effort for a new elastomeric film and laminate that generated a new \$60MM per year business for the company.

Paragon Trade Brands - Norcross, GA (currently First Quality, Inc) August, 1994 – April, 1999

EXECUTIVE VICE PRESIDENT, Operations, Technology and International

EXECUTIVE VICE PRESIDENT International Development

Dec., 1997 – Jan., 1998

Sr. VICE PRESIDENT

Corporate Materials and Technology

Nov. 1995- Dec., 1997

Accountable for all Operations, Logistics, Purchasing, R&D, Engineering and Quality departments, as well as responsible for the International joint ventures of the corporation. Paragon was in the business of manufacturing personal care absorbent products such as baby diapers, sanitary napkins and adult incontinent products. It controls about 70% of the baby diaper private label/store brands. Budgetary responsibility of \$485 million dollars and over 1000 associates in six North American plants and in six countries (Mexico, Brazil, Argentina, PRChina, Canada and USA). Member of Board of Directors of several International Joint Venture companies.

- Implemented the SAP operating system across all manufacturing and logistic areas in 1998 without any major disruption to operations.
- Improved manufacturing costs by 15% during the first three months of being given that responsibility resulting in approximately \$2MM per year in reduced operating costs.
- Identified and closed on two Joint Ventures in 1997, one in Brazil and one in the People's Republic of China. Both operations were green-field sites and still in existence.
- Led the development and commercialization of the new Ultra Thin "*White Cloud®*" diaper at a minimum cost increase basis, and the development of the new and improved Training Pant. Both products were improved from 80:20 losers to parity preference and performance to the key brands. Training pants sales have reached well over \$140MM in sales.
- Reduced packaging costs by \$15MM per year and led the major U.S. diaper producers in surface printing of diaper bags.
- Reduced raw material costs by \$ 23MM (excluding pulp) in 1996 through improved pricing negotiations and material substitutions.

Confab, Incorporated - King of Prussia, PA (currently First Quality, Inc)

1993-1994

VICE-PRESIDENT OF R&D and QUALITY ASSURANCE

Accountable for product, process, material development and quality control for a major private label manufacturer of personal care absorbent products with mission for growing the business both domestically and internationally.

- Commercialized four new products that increased sales by 5% and profits by 8%. Developed three other products that were commercialized during the early part of 1994.
- Implemented a cost reduction program that contributed 13% of the profitability for 1993 and implemented one that resulted in 10% contribution to profits in 1994.
- Implemented a completely new Quality Control system that improved quality and reduced QA labor by 40%. Led effort towards pursuing ISO 9000 registration.

Kimberly-Clark Corporation-Neenah, WI

1983-1993

DIRECTOR INFANT CARE ADVANCED PRODUCT DEVELOPMENT

Responsible for major strategic Infant Care project and long term product development efforts.

- Responsible for the commercialization of Huggies® Supreme, the development of the second generation Supreme diaper and the development of the new Diaper 2000.

DIRECTOR OF ADULT CARE R&D

1989-1992

Responsible for sector R&D department with global accountability for new product, product development, manufacturing and marketing support, and International support for the manufacture of the Depend® line of incontinence products.

- Conceived, developed, and commercialized Poise® bladder control pads that are currently a \$180MM business for the company.
- Re-staged full line of Depend products that increased the per year growth rate while netting a 3% saving in product cost.

DIRECTOR OF INFANT CARE BUSINESS SUPPORT

1987-1989

Directed major technical department that implemented and commercialized new product improvements to the Huggies® line of infant diapers and performed manufacturing support to eight manufacturing plants in the US. and Canada.

- Developed and implemented the Him-Her Huggies products that were preferred 3:1 to competition and resulted in a 22% share of the Huggies product mix with \$250 million in sales. Commercialized tape-landing-zone, non-woven transfer layer, improved non-woven waist elastic and new improved leg gathers diapers.
- Led a multi-functional task force in major cost reduction program that resulted in 7% product cost reduction for the diaper business.
- Substantiated the advertising claims for the "driest Huggies ever" that helped increase share by 2%.

DIRECTOR PERSONAL CARE NON-WOVEN MATERIALS DEVELOPMENT

1985-1987

Roswell, GA

Directed major R&D department that developed non-woven materials, composites and engineered structures to the Personal Care sectors. Supported International companies in the development and start-up of bonded carded web processes and materials.

- Developed and commercialized a new fiber geometry spunbond diaper liner that provided improved softness at a 30% cost advantage over the material competition was using.
- Convinced senior management of the technical feasibility for the commercialization of elastomeric non-woven that became an integral part of the Pull-Ups® training pants resulting in a new business that contributed 15.8 % sales increase to the Consumer Products Division.
- Development of “coform” substrate for Huggies Baby Wipes.

SR. RESEARCH MANAGER FEMININE CARE BUSINESS SUPPORT

1983-1985

Neenah, WI

Supervised technical department that supported marketing and manufacturing of feminine care sanitary products.

- Co-invented and commercialized the Kotex®Profile® sanitary napkin (US Patent 4,639,254) which salvaged \$10 million in sunk capital from previous aborted program and resulted in additional sales of \$5 million per year.
- Commercialized and developed two thin-maxi products; pre-cursors to the ultra-thin design.

Burlington Industries, Inc., Formed Fabrics Division -Greensboro, NC (currently Precision Fabrics Co.)

DIRECTOR of MANUFACTURING AND TECHNICAL DEVELOPMENT

1981-1983

Manufacturing, product and process development responsibility for a new technology non-woven fabric (ultrasonically bonded web) designed for the home furnishing and medical fabrics markets to compete with spunlace.

American Can Company- Neenah and Green Bay, WI (currently Georgia-Pacific Corp.)

MANAGER AIR-LAY TECHNOLOGY

1976-1981

Coordinated the multi-functional efforts for the commercialization of \$100MM project in new air-lay non-woven technology, with line responsibilities for manufacturing and process development.

Scott Paper Company- Chester, PA and Sandusky, OH (currently Kimberly-Clark Corporation)

MANAGER PROCESS SERVICES

1970-1976

Responsible for mill technical services, process control and development of new paper making process for the production of Job Squad® kitchen towels, Tracel® service wipes and Baby Fresh® baby wipes. Worked in wet-lay consumer tissue manufacturing as process engineer on Viva® kitchen towels and Cottonelle® bathroom tissue.

PATENTS: 5 US Pat issued and 3 US Pat Applications published

B.S. Chemical Engineering-1970
Drexel University, Philadelphia, PA
Fluent in Spanish, Portuguese, Italian
Working Knowledge of French