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S P E C I F I C A T I O N

FASTENING SYSTEM FOR WEARING ARTICLE

5 TECHNICAL FIELD

[0001]

The present invention relates generally to fastening systems for wearing articles and particularly to such fastening systems for disposable diapers.

10 RELATED ART

[0002]

There are well known fastening systems for connect front and rear waist regions of a wearing article by a mechanical fastener comprising a hook component and a loop component detachably engageable with the hook component. For example, 15 JP2002-532147T (hereinafter referred to as "PATENT DOCUMENT 1") discloses a diaper adapted to be fastened around a diaper wearer's body by means of mechanical fasteners respectively provided on transversely opposite side edges of the diaper. The 20 diaper disclosed therein adopts a fastening system having a hook component 107 provided on an outer side of the diaper as illustrated in Fig. 5A in the accompanying drawing of the present specification, to prevent the hook component 107 from

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coming in contact with the wearer's skin and creating a feeling of discomfort against the wearer.

[0003]

However, even in the case of such a fastening system
5 having the hook element 107 protruding outward with respect to the wearer's body, it is likely that the hook component 107 might be curled as illustrated in Fig. 5B and irritate the wearer's skin if a force F functioning to disengage the hook component 107 from the loop component is exerted on a free end 113 of a
10 attachment sheet 120 carrying the hook component 107.

[0004]

JP1997-191908A (hereinafter referred to as "PATENT DOCUMENT 2") discloses a fastening system having a construction as illustrated in Fig. 5C, wherein a hook component 107 is bonded
15 to an attachment sheet 120 via a base sheet 105 which is, in turn, provided on its rear surface with a joining area 114 and a non-joining area 115 to the diaper, and the non-joining area 115 is located aside toward the free end 11 of the hook component 107. With this fastening system, the hook component 107 would
20 not be easily disengaged from the loop component 108 even if the hook component 107 is moved so as to be vertically spaced from the loop component 108.

DISCLOSURE OF THE INVENTION

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PROBLEMS TO BE SOLVED BY THE INVENTION

[0005]

In the case of the fastening system disclosed in Reference 2, the base sheet 105 is provided on its rear side with the joining area 114 and the non-joining area 115 to the attachment sheet 120. Such an arrangement certainly ensure that a section of the attachment sheet 120 extending from a border 127 between the joining area 114 and the non-joining area 115 to the free end 113 is deformed, as illustrated in Fig. 5C, in response to the force F oriented to disengage the hook component 107 from the loop component 108 and thereby the hook component 107 is protected from being easily curled.

[0006]

With the fastening system disclosed in Reference 2, however, when an engagement strength between the hook component 107 and the loop component 108 is higher than tear strength of the base sheet 105, it is likely that the hook component 107 could not be disengaged from the loop component 108 in the non-joining area 115 and, as a result, the base sheet 105 might be torn apart along the border 127 between the joining area 114 and the non-joining area 115.

[0007]

It is an object of the present invention to provide a

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fastening system for a wearing article provided with a hook component and a loop component so improved that the hook component are protected from being easily curled and the base sheet is protected from being torn as the hook component is
5 disengaged from the loop component.

MEASURE TO SOLVE THE PROBLEMS

[0008]

According to the present invention, there is provided a fastening system for a wearing article comprising: a first
10 waist region corresponding to one of front and rear waist regions and having transversely opposite first side edge portions; a second waist region corresponding to the other of the front and rear waist regions and having transversely opposite second side edge portions; a crotch region extending
15 between said first and second waist regions; hook carrying side edge portions provided along the transversely opposite first side edge portions and having respective hook components secured thereto; and loop carrying side edge portions provided along the transversely opposite second side edge portions and
20 having respective loop components secured thereto which are detachably engageable with the respective hook components.

[0009]

The present invention is characterized in that each of

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the hook carrying side edge portions comprises a first sheet section extending outward from each of the transversely opposite first side edge portions, a second sheet section being contiguous to an outer side edge of the first sheet section and extending toward each of the transversely opposite first side edge portions, a joining area extending in parallel to and spaced from the outer side edge so as to join the first sheet section to the second sheet section, and a non-joining area surrounded by the joining area, the first and second sheet sections and the outer side edge; and each of the hook components has first and second side edges extending in parallel to the outer side edge and is secured to one of the first sheet section and the second sheet section in such a manner that the first side edge lies in the joining area while the second side edge lies in the non-joining area.

[0010]

According to one preferred embodiment of the invention, the first sheet section and the second sheet section are formed from a unitary sheet element and the unitary sheet element is folded back along the outer side edge to form each of the hook carrying side edge portions.

[0011]

According to another preferred embodiment of the

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invention, at least one of the first sheet section and the second sheet section is formed in the non-joining area with at least one slit including a directional component parallel to the outer edge.

5 [0012]

According to still another preferred embodiment of the invention, the hook component comprises a base sheet made of thermoplastic resin and a plurality of hook elements protruding from a top surface of the base sheet, the first and second sheet
10 sections are formed from a nonwoven fabric containing thermoplastic resin fibers, both the base sheet and the nonwoven fabric have a tear strength being relatively low in one direction and relatively high in a direction orthogonal to the one direction, and the hook component is secured to one of the
15 first and second sheet section in such a manner that the one direction in which the base sheet exhibits a relatively low tear strength does not coincide with the one direction in which the nonwoven fabric exhibits a relatively low tear strength.

[0013]

20 According to further another preferred embodiment of the invention, a reinforcing sheet is secured to the base sheet.

EFFECT OF THE INVENTION

[0014]

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According to the present invention, the base sheet for the hook component is secured to one of the first and second sheet sections and thereby reinforced by a nonwoven fabric constituting the first and second sheet sections. In this way, 5 the hook component is protected from being torn apart in the course of disengaging the hook component from the loop component.

[0015]

The portions of first and second sheet sections 10 surrounding the non-joining area are deformable in response to a force oriented to disengage the hook component from the loop component exerted on the outer side edge being contiguous to these first and second sheet sections so as to cover the outer side edge of the hook component and thereby to protect the hook 15 component against being easily curled.

[0016]

When the portions of first and second sheet sections surrounding the non-joining area are further entrained during deformation due to the force functioning to disengage the hook 20 component from the loop component, such force is divided into the force component oriented toward the second side edge of the hook component and the force component oriented toward the border between the non-joining area and the joining area.

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Consequentially, the force functioning for disengagement of the hook component is correspondingly weakened and the hook component is protected against being easily curled.

BRIEF DESCRIPTION OF THE DRAWINGS

5 [0017]

[FIG. 1] Fig. 1 is a perspective view of a diaper with its front and rear waist regions separated from each other on one side of their transversely opposite side edge portions.

[FIG. 2] Fig. 2 is a diagram schematically illustrating an embodiment of the fastening system according to the present invention.

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[FIG. 3] Fig. 3 is a schematic diagram illustrating the fastening system, in which Fig. 3A illustrates a state of the fastening system before a force is exerted on an outer end, and Fig. 3B as well as Fig. 3C illustrates a state of the fastening system when a force is exerted on the outer end.

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[FIG. 4] Fig. 4 is a schematic diagram illustrating another embodiment of the fastening system according to the present invention.

[FIG. 5] Fig. 5 is a schematic diagram illustrating the fastening systems of prior art, in which Fig. 5A as well as Fig. 5B illustrates the fastening system disclosed in Reference 1 and Fig. 5C illustrates the fastening system disclosed in

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Reference 2.

IDENTIFICATION OF REFERENCE NUMERALS USED IN THE DRAWINGS

[0018]

- | | |
|----|--|
| 1 | fastening system |
| 5 | 2 first (front) waist region |
| | 3 second (rear) waist region |
| | 5 base sheet |
| | 6 hooks |
| | 7 hook component |
| 10 | 8 loop component |
| | 10 diaper (wearing article) |
| | 11 first sheet section |
| | 12 second sheet section |
| | 13 outer side edge |
| 15 | 14 joining area |
| | 15 non-joining area |
| | 16 first side edge |
| | 17 hook carrying side edge portion |
| | 18 loop carrying side edge portion |
| 20 | 19 second side edge |
| | 20 sheet element |
| | 21 transversely opposite first side edge portion |
| | 22 slits |

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31 transversely opposite second side edge portion

DESCRIPTION OF THE BEST MODE FOR WORKING OF THE INVENTION

[0019]

Details of the fastening system 1 for wearing articles
5 according to the present invention will be more fully understood
from the description given hereunder exemplarily with respect
to the case of a diaper 10 with reference to the accompanying
drawings.

[0020]

10 The diaper 10 shown in Fig. 1 in a perspective view
comprises a longitudinal direction Y, a transverse direction
X, a waist surrounding direction Z, a liquid-permeable body side
liner 10A defining a body side surface 10a, a liquid-impermeable
outer sheet 10B defining a garment side surface 10b and a
15 liquid-absorbent core (not shown) interposed the body side
liner 10A and the outer sheet 10B, and further comprises a front
waist region 2, a rear waist region 3 and a crotch region 4
extending between these two regions 2, 3. Waist surrounding
elastic elements 42 are attached under tension along a waist
20 hole defining edges 41 of the front and rear waist regions 2,
3 while leg surrounding elastic elements 44 are attached under
tension along a pair of leg hole defining edges 43. In addition,
the front and rear waist regions 2, 3 are provided with auxiliary

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elastic elements 45 attached under tension thereto so as to extend circumferentially in the waist surrounding direction Z and to provide a good fit of the diaper 10 to the wearer's body.

[0021]

5 The fastening system 1 for the diaper 10 comprises hook carrying side edge portions 17 provided along the transversely opposite first side edge portions 21 of the front waist region 2 to which respective hook components 7 are permanently bonded and loop carrying side edge portions 18 provided along the
10 transversely opposite second side edge portions 31 to which respective loop components 8 are permanently bonded.

[0022]

As will be appreciated, both the hook component 7 and the loop component 8 constitute a so-called mechanical fastener
15 adapted to be detachably engaged with each other. When the diaper 10 is put on the wearer's body, the loop carrying side edge portions 18 may be pressed against the associated hook carrying side edge portions 17. When the diaper 10 is taken
20 off from the wearer's body, for example, the upper ends 25 of the loop carrying side edge portions 18 including the loop components 8 may be gripped by the wearer's fingers and then the loop components 8 may be sequentially disengaged from the hook component 7.

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[0023]

Each of the hook carrying side edge portions 17 is formed of a unitary sheet element 20 extending outward from the associated one of the transversely opposite first side edge portions 21 of the front waist region, then folded back onto the side edge portion 21 along a line extending in parallel to the side edge portion 21 so as to define an outer side edge 13 of this hook carrying side edge portions 17 and provided with the hook component 7 so as to protrude outward with respect to the diaper wearer's body.

[0024]

A section of the sheet element 20 extending from the side edge portion 21 of the front waist region 2 to the outer side edge 13 is referred to herein as a first sheet section 11 and the remaining section of the sheet element 20 extending from the outer side edge 13 back to the side edge portion 21 is referred to herein as a second sheet section 12. It should be understood that the sheet element 20 preferably comprises a fibrous nonwoven fabric containing thermoplastic resin fibers.

[0025]

As schematically illustrated in Fig. 2, the first and second sheet sections 11, 12 are joined together in a joining area 14 extending in parallel to and spaced apart from the outer

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side edge 13 by means of hot melt adhesive HM but free from each other in a non-joining area 15 surrounded by the first and second sheet sections 11, 12 and the outer side edge 13.

[0026]

5 The hook component 7 comprises a base sheet 5 made of thermoplastic resin and a plurality of hook elements 6 protruding from a top surface of the base sheet 5. The base sheet 5 has a first side edge 16 extending in parallel to the associated one of the transversely opposite side edge portions
10 21 of the front waist region 2 and a second side edge 19 opposed to the first side edge 16. The base sheet 5 is permanently bonded to the first sheet section 11 by means of hot melt adhesive HM so that the first side edge portion 16 may overlie the joining area 14 while the second side edge portion 19 may overlie the
15 non-joining area 15.

[0027]

With such an arrangement, hot melt adhesive HM cooperates with the nonwoven fabric constituting the first sheet section 11 to reinforce the base sheet 5 and thereby the hook component
20 7 is prevented from tearing apart when the loop component 8 is disengaged from the hook component 7. To achieve this, the nonwoven fabric preferably has a tear strength higher than a tear strength of the hook component 7. The hook component 7

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can be prevent from tearing apart more reliably by bonding a reinforcing sheet (not shown) such as a nonwoven fabric or plastic film to the base sheet 5 prior to permanently bonding the base sheet 5 to the first sheet section 11 constituting the hook carrying side edge portion 17. Hot melt adhesive HM is preferably applied substantially over the whole area of the base sheet 5.

[0028]

Generally, the base sheet 5 made of a thermoplastic resin exhibits a relatively low tear strength in the direction of extrusion for sheet forming. Specifically, if the thermoplastic resin is extruded in the direction parallel to the direction in which the side edge portion 21 of the waist region extend (i.e., the direction in which the loop carrying side edge portion extends from its upper end 25 to its lower end 26), the base sheet 5 would be disadvantageously apt to be torn apart when the loop component 8 is disengaged from the hook component 7.

[0029]

The sheet element 20 made of a nonwoven fabric also may exhibits a relatively low tear strength in the direction of extrusion for sheet forming. In such case, it is essential to avoid such a relationship that the direction in which the base

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sheet 5 exhibits the lower tear strength coincides with the direction in which the sheet element 20 exhibits the lower tear strength in order to enhance a desired reinforcing effect of the sheet element 20 for the base sheet 5 and thereby to protect the base sheet 5 further reliably from being easily torn apart.

[0030]

The hook component 7 has a tear strength preferably in a range of 0.3 to 3.0 N, more preferably in a range of 0.5 to 1.2 N. If the tear strength of the hook component 7 is less than 0.3 N, this tear stretch is not enough to manufacture and to practically use the hook component 7 so that some troubles might happen. If the tear strength of the hook member 7 exceeds 3.0 N, the base sheet 5 of the hook component 7 will become undesirably stiff and increase a feeling of discomfort during use of the diaper. The nonwoven fabric constituting the sheet member 20 has a tear strength preferably in a range of 3.5 to 25 N, more preferably in a range of 5.0 to 17 N.

[0031]

If the tear strength is less than 3.5 N, this tear stretch is not enough to make the sheet element 20 to serve as the reinforcing material. If the tear strength exceeds 25 N, the nonwoven fabric constituting the sheet element 20 will become undesirably stiff and increase a feeling of discomfort during

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use of the diaper.

[0032]

The tear strength is measured in a manner as follows:
Assuming that the direction in which the base sheet 5 or the
5 nonwoven fabric of the hook carrying side edge portion 7 to be
tested was sheet-formed corresponds to its longitudinal
direction and the direction orthogonal to this corresponds to
its transverse direction, a sample of the hook carrying side
edge portion 17 having a length of 50 mm and a width of 30 mm
10 is prepared. Then the sample is formed with a slit having a
length of 20 mm long in the longitudinal direction from a point
on one end of the sample bisecting the width of this sample by
using a cutter. Along the slit, the sample is bifurcated and
respective finger-grip margins of approximately 15 mm are
15 attached to a tensile tester with an inter-chuck distance of
10 mm. Then the respective finger-grip margins are pulled in
opposite directions at a pulling rate of 300 mm/min and a value
of the maximum load measured until the sample is broken is
determined as the tear strength of this sample.

20 [0033]

Referring to Fig. 2, the arrangement in which hook
elements of the hook components 7 of the hook carrying side edge
portion 17 protrude outward with respect to the wearer may cause

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a problem since the outer side edge 13 of the hook carrying side edge portion 17 is present inside the diaper 10 and apt to come in contact with the wearer's skin. Consequentially, if the wearer twists his or her body or inserts his or her fingers between the diaper 10 and his or her body and slidably moves these fingers circumferentially along his or her waistline, a force oriented to disengage the hook component 7 from the loop component 8 may be exerted on the outer side edge 13.

[0034]

10 With the fastening system 1 according to the present invention, even if a force oriented to disengage the hook component 7 from the loop component 8 is exerted on the outer side edge 13, the hook component 7 is prevented from being partially or wholly disengaged from the loop component 8 as will
15 be described hereinafter with reference to Fig. 3A through Fig. 3C. Fig. 3A is a schematic diagram illustrating a state before the force F oriented to disengage the hook component 7 from the loop component 8 is exerted on the outer side edge 13 while Fig. 3B and Fig. 3C are schematic diagrams illustrating states under
20 such force F exerted on the outer side edge 13.

[0035]

As illustrated in Fig. 3A, a portion of the sheet element 20 extending from the outer side edge 13 to the second side edge

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19 of the base sheet 5 as well as a portion of the sheet element
20 extending from the outer side edge 13 to a border 27 between
the non-joining area 15 and the joining area 14 is not joined
to the other elements, i.e., free. Consequentially, these
5 portions are deformable under an external force. These
deformable portions will be collectively referred to
hereinafter as a deformable area 30.

[0036]

When the wearer's movement causes the force F oriented
10 to disengage the hook component 7 from the loop component 8 is
exerted on the outer side edge 13, the outer side edge 13 is
pushed by the force F and the deformable area 30 begins to be
deformed since the outer side edge 13 extends outward beyond
the second side edge 19 of the base sheet 5 constituting the
15 hook component 7 as illustrated by Fig. 3A. Thus, the
deformable area 30 is deformed so as to cover the second side
edge 19 of the base sheet 5 constituting the hook component 7
as illustrated in Fig. 3B.

[0037]

20 If the force F continues to be exerted on the outer side
edge 13, the deformable area 30 of the sheet element 20 will
be displaced but remain to cover the second side edge 19 and
thereby prevent the hook component 7 from being easily curled

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or disengaged from the loop component 8. Also, the force F is oriented to press the hook component 7 against the loop component 8.

[0038]

5 The deformable area 30 is deformed under an entraining effect of the force F oriented to disengage the hook component 7 from the loop component 8 until the deformable area 30 takes a position as illustrated in Fig. 3C. Thereupon, the force F is divided into a component f1 oriented toward the second side
10 edge 19 of the hook component 7 and a component f2 oriented toward the border 27 between the non-joining area 15 and the joining area 14. This means that the force exerted on the outer side edge 13 is reduced and the hook component 7 is prevented from being curled and disengaged from the loop component 8.

15 [0039]

Fig. 4 is a schematic diagram illustrating an alternative embodiment of the fastening system 1. According to this alternative embodiment, the first sheet section 11 of the sheet element 20 on which the hook components 7 are permanently bonded
20 is formed with a plurality of slits 22 each extending obliquely with respect to the outer side edge 13.

[0040]

According to this embodiment, the area of the first sheet

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section 11 in which the slits 22 are formed is stretched as the deformable area 30 is entrained and deformed under the force F oriented to disengage the hook component 7 from the loop component 8. As a result, the component of the force oriented toward the second side edge 19 of the hook component 7 is sufficiently reduced to protect the hook component 7 against being easily curled or disengaged from the loop component 8.

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[0041]

The elastic components such as the waist-surrounding elastic elements 42 and the auxiliary elastic elements 45 are processed preferably in such a manner that no elasticity should be expressed by these elastic elements immediately under the loop component 8. This can be achieved by cutting, coating with a hot melt adhesive or chemical treatment of these elastic elements such as the auxiliary elastic elements 45 lying immediately under the loop component 8. In this way, the loop component 8 can be prevented from getting wrinkles and a bond strength between the loop component 8 and the hook component 7 can be prevented from deteriorating.

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20 [0042]

While the fastening system according to the present invention has been described above on the basis of the preferred embodiments thereof, the present invention is not limited to

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such embodiments but may be exploited in the other various manners. For example, it is possible without departing from the spirit and the scope of the invention to arrange hook elements of the hook component 7 so as to protrude not outward
5 but inward. With this arrangement, it is unlikely that the hook component 7, if curled, might damage the wearer's garment or bedclothes.

[0043]

It is also possible without departing from the spirit and
10 the scope of the invention to form the hook carrying side edge portion 17 from a pair of sheets instead of the unitary sheet element. In this case, these two sheets may be bonded to each other along edges thereof destined to define the outer side edge
13. However, it will be appreciated that the illustrated
15 embodiment having the hook carrying side edge portion 17 formed of the unitary sheet element is preferred to the alternative embodiment as has been described just above since the deformable area 30 including none of joined portions is smoothly deformable. In addition, bonding of the first and second sheet sections 11,
20 12 as well as permanent bonding or planting of the hook component 7 may be carried out not only by means of hot melt adhesive HM but also by means of the other well known technique such as heat sealing or ultrasonic sealing. Furthermore, the loop

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component 8 comprising the loop elements of the mechanical fastener may be replaced by a nonwoven fabric adapted to be engaged with the hook component.

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C L A I M S

[1] A fastening system (1) for a wearing article comprising:

5 a first waist region (2) corresponding to one of front and rear waist regions and having transversely opposite first side edge portions (21);

a second waist region (3) corresponding to the other of said front and rear waist regions and having transversely opposite second side edge portions (31);

10 a crotch region (4) extending between said first and second waist regions;

hook carrying side edge portions (17) provided along said transversely opposite first side edge portions and having respective hook components secured thereto;

15 loop carrying side edge portions (18) provided along said transversely opposite second side edge portions and having respective loop components secured thereto which are detachably engageable with said respective hook components;

wherein said fastening system is characterized in that:

20 each of said hook carrying side edge portions comprises a first sheet section extending outward from each of said transversely opposite first side edge portions, a second sheet section being contiguous to an outer side edge (13) of said first

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sheet section and extending toward each of said transversely opposite first side edge portions, a joining area extending in parallel to and spaced from said outer side edge so as to join said first sheet section to said second sheet section, and a
5 non-joining area surrounded by said joining area, said first and second sheet sections and said outer side edge; and

each of said hook components has first and second side edges (16, 19) extending in parallel to said outer side edge and is secured to one of said first sheet section and said
10 second sheet section in such a manner that said first side edge lies in said joining area while said second side edge lies in said non-joining area.

[2] The fastening system for the wearing article defined by
15 Claim 1 wherein said first sheet section and said second sheet section are formed of a unitary sheet element and said unitary sheet element is folded back along said outer side edge to form each of said hook carrying side edge portions.

20 [3] The fastening system for the wearing article defined by Claim 1 or 2 wherein at least one of said first sheet section and said second sheet section is formed in said non-joining area with at least one slit including a directional component

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parallel to said outer side edge.

[4] The fastening system for the wearing article defined by any one of Claims 1 through 3 wherein said hook component
5 comprises a base sheet made of thermoplastic resin and a plurality of hook elements protruding from a top surface of said base sheet; said first and second sheet sections are formed of a nonwoven fabric containing thermoplastic resin fibers; both said base sheet and said nonwoven fabric have a tear strength
10 being relatively low in one direction and relatively high in a direction orthogonal to said one direction; and said hook component is secured to one of said first and second sheet section in such a manner that said one direction in which said base sheet exhibits a relatively low tear strength does not
15 coincide with said one direction in which said nonwoven fabric exhibits a relatively low tear strength.

[5] The fastening system for the wearing article defined by Claim 4 wherein a reinforcing sheet is secured to said base
20 sheet.