



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 158(3) EPC

(43) Date of publication:
06.02.2002 Bulletin 2002/06

(51) Int Cl.7: **D04B 1/02, D04B 21/02**

(21) Application number: **00905378.6**

(86) International application number:
PCT/JP00/01137

(22) Date of filing: **28.02.2000**

(87) International publication number:
WO 00/55408 (21.09.2000 Gazette 2000/38)

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**

• **TEIJIN LIMITED**
Osaka-shi Osaka 541-0054 (JP)

(30) Priority: **17.03.1999 JP 11534399**
16.07.1999 JP 20375799
14.02.2000 JP 2000035990

(72) Inventor: **MUNE, Junichiro**
Joyo-shi, Kyoto 610-0111 (JP)

(71) Applicants:
• **Sumitomo Corporation**
Osaka-shi, Osaka 540-8666 (JP)

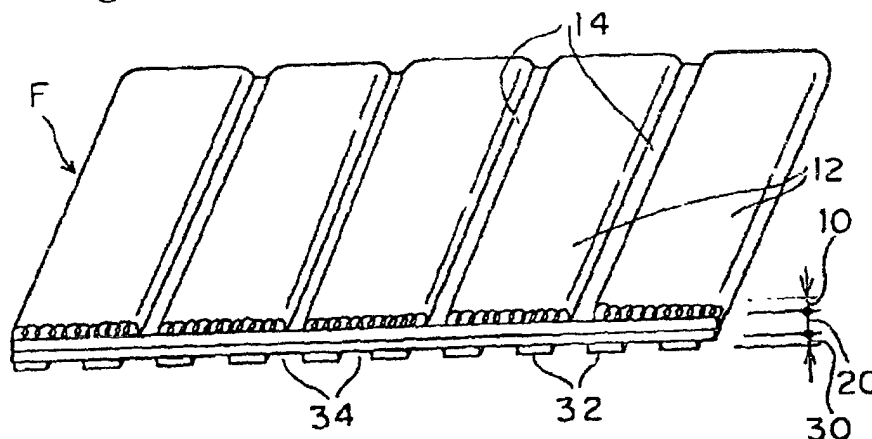
(74) Representative: **Henkel, Feiler, Hänzel**
Möhlstrasse 37
81675 München (DE)

(54) **WATER-ABSORPTION-CONTROLLING-FUNCTION KNITTING**

(57) An outer ply comprises a pile design, whereby convex parts (pile parts) 12 and concave parts (concavity parts) 14 are formed. An under ply comprising a knit

design with a large number of see-through portions 34 is had at the backside of a middle ply 20 which supports an outer ply 10.

Fig. 1



Description**TECHNICAL FIELD**

5 **[0001]** The present invention relates to knitted goods (knitted fabrics) with a function of controlling water absorption, and the object thereof is knitted goods of which functions such as water absorption from the surface, retention of water absorption, and prevention of a back flow are appropriately controlled.

BACKGROUND ART

10 **[0002]** Among products for care as used so far by the aged, the sick, the physically handicapped and the like, a paper diaper has recently been a mainstream product especially with respect to a diaper for care.

[0003] However, the increase of users of the paper diaper and the diaper as thrown away after once-use cause the generation of huge garbage, and the diaper is getting a serious problem in a viewpoint of preservation of the environment.

15 **[0004]** On the one hand, with respect to a prior cloth diaper as a many-times-usable diaper for care, excretions remain on the surface of a cloth, whether excretions are liquid wastes or solid wastes, and excretions give an uncomfortable and unclear feeling to the users of the diaper. Therefore, the cloth diaper has recently not often used.

20 **[0005]** In case of the prior cloth diaper, the cloth diaper is reusable by washing. However, there is a problem that the used cloth have no function to remove water from the surface thereof, or that even if water can be removed once, the cloth lost a dry touch because of water returning to the surface, if the cloth is pressed by the pressure of weight.

25 **[0006]** In case of the paper diaper, the paper diaper is made by using a high molecular water-absorbent polymer so that the paper diaper cannot return once-absorbed water to the surface. This is highly valued in a viewpoint of a clean feeling and a feeling in use by the users of the diaper. However, the paper diaper made by using the high molecular water-absorbent polymer brings about the result that the users of the diaper and their caretakers are forced to pay a lot of money, because not only is the selling price high, but also the paper diaper is used only once and then thrown away.

DISCLOSURE INVENTION**OBJECT OF THE INVENTION**

30 **[0007]** An object of the present invention is to provide knitted goods (knitted fabrics) with a function of controlling absorption which not only have a high property of water mobility and a property of preventing water from moving again that a paper diaper has as a material used for a diaper for care, but also which is reusable by washing many times without deteriorating the functions.

SUMMARY OF THE INVENTION

40 **[0008]** Knitted goods (knitted fabrics) with a function of controlling water absorption of the present invention are knitted goods (knitted fabrics) of which the outer ply comprises a pile design, and the knitted goods are characterized by comprising a large number of convex parts and concave parts, wherein the convex parts and the concave parts are formed by the pile design.

[0009] Knitted goods (knitted fabrics) with a function of controlling water absorption of the present invention are knitted goods (knitted fabrics) with a multi-ply structure in which a plurality of knit design ply are piled, and includes:

45 an outer ply which comprises a pile design, having a large number of convex pile parts and concave parts, wherein nap of the convex pile parts is raised and the concave parts are arranged between the pile parts and form vacant spaces,

50 a middle ply which is arranged at the backside of the outer ply, supports the pile part, and comprises the knit design which is denser than the knit design of the outer ply, and

an under ply which is arranged at the backside of the middle ply and comprises the knit design with a large number of see-through portions.

55 **[0010]** Fibers comprising knitted goods are preferably non-water-absorbing fibers.

DETAILED DESCRIPTION OF THE INVENTION

[0011] The present invention is hereinafter illustrated in detail. Knitted goods have the same meaning as knitted

fabrics.

[Knitted goods with multi-ply structure]

[0012] Knitted goods with a multi-ply structure are knitted goods that are made by piling a plurality of knit design ply and knitting them in one, wherein some structure differs between a plurality of knit design ply in that the knit design is different and that the thickness or kind of a used yarn is different in spite of the same knit design.

[0013] Because knitted yarn doesn't become tangled with one another or don't go in and out between the neighboring ply, it does not follow that each ply is separated from one another and exists at an independent state.

[0014] Knitted goods with a multi-ply structure of the present invention include a structure comprising at least three ply; an outer ply, a middle ply, an under ply.

[0015] Knitted goods with a multi-ply structure can be knitted by a warp knitting machine with a plurality of reeds. Knitted goods with a multi-ply structure can be made up by establishing the thickness, kind, and providing condition of yarn used for each reed and a knit design.

[Outer ply]

[0016] An outer ply comprises a pile design, whereby a large number of convex parts and concave parts are made up. In preferable embodiments, the concave parts usually comprise parts without a pile design, that is to say, a non-pile design, so that in the present description the aforementioned convex parts are usually called pile parts. However, the concave parts are not necessarily the non-pile design, in short have only to be lower than the concave parts and to exhibit concavity. Accordingly, there are some cases where the concave parts are formed by a low pile design.

[0017] A similar structure to a general pile knitted goods is adopted for the pile design. That is to say, the pile design is usually formed on a texture design. However, if a below-mentioned under ply or such is formed at the backside of the texture design to become knitted fabrics with a multi-ply structure as a whole, the texture design is regarded as a middle ply of a multi-ply structure.

[0018] A ring loop type in which yarn projects in a ring state can be adopted as a pile structure. For example, sharkskin design or satin design can be adopted as a basic knit design. As more specific structure, such a knit design as denoted by (10/34), (10/45), (10/56), (10/67), and (10/78) can be adopted.

[0019] A pile composing a pile design is given nap raising. The treatment of nap raising makes an excellent skin touch and water removability. The treatment of nap raising can be performed in later processing after knitted goods with a multi-ply structure are knitted. The treatment of nap raising can be also performed before dyeing processing.

[0020] Relatively thick yarn is preferable as yarn making up a pile design. Specifically, the yarn of which the monofilament denier is in the range of 2.5 to 5.5 can be used, and the yarn of which the monofilament denier is in the range of 2.5 to 4.5 can preferably be used. The total denier of the yarn can be established in the range of 70 to 250 denier, preferably in the range of 100 to 210 denier. Thick yarn is good in the passage of water, and also excellent in quick drying and durability after washing. As yarn in the outer ply, the yarn of which the monofilament denier is thicker than the monofilament denier of yarn in a middle ply and an under ply is used.

[0021] Such a below-mentioned hydrophobic fiber (non-water-absorbing fiber) as does not absorb water is often used as a material of the yarn. However, there are some cases where the hydrophobic fiber is used together with hydrophilic yarn. Specifically, polyester yarn can be used as the hydrophobic yarn. The polyester yarn is good in quick drying after washing. Especially, it becomes possible to improve durability such as endurance to washing by using polyester high tenacity yarn of which strength is raised. Examples of other yarn materials include any synthetic fibers such as polyamide and cotton, and natural fibers.

[0022] A pile design can be composed of plural kinds of yarn which differs in the thickness and the quality of materials. The convex parts (These are hereinafter called pile parts) comprise the aforementioned pile design, and a loop or a tassel of yarn projects to form convexity. In case of use for a diaper or such, the tips of the pile parts touch a skin. In use the pile parts transform flexibly to exhibit a cushion effect.

[0023] The concave parts, non-pile design parts (These are hereinafter called concavity parts) are arranged between each of pile parts, and forms vacant spaces. Water making contact with the outer ply moves through the concavity parts from a middle ply to an under ply. The concavity parts function as spaces that allow the pile parts to transform flexibly.

[0024] Knitted goods with a function of controlling water absorption of the present invention are characterized in that the outer ply thereof has the concavity parts.

[0025] An arrangement of the pile parts and the concavity parts can be appropriately established according to uses and demanded capacities. In case of use for a cloth diaper or such, the arrangement of the pile parts and the concavity parts, and a property thereof have an influence on a skin touch, a water absorption capacity or such.

[0026] The pile parts can be arranged in a straight rib state so that a groove-like concavity parts can be arranged

between rib-like pile parts. Ribs formed by the pile parts can be also arranged in a curved line or a bending line. The width of the ribs may be constant, or the width may vary continuously or gradually in a longitudinal direction. Plural kinds of ribs that differ from each other in the width can be used in combination.

[0027] The pile parts can be arranged in a lattice-like or net-like state so that the concavity parts can be arranged in a space surrounded by the pile parts. The pile parts can also be arranged in an island-like or spot-like state so that the pile parts can be arranged in a structure in which the surrounding of the pile parts is surrounded by the concavity part.

[0028] The pile parts and the concavity parts can be arranged at the intervals of 5 ± 2 in number per 10 cm. The intervals are preferably 5 ± 0.5 in number per 10 cm. Here, in case where one pile part and one concavity part are arranged in 10 cm knitted goods, the one pile part and one concavity part is calculated as 1. In case of either thereof, either thereof is calculated as 0.5. There is a merit that the larger the arrangement number of the pile parts and the concavity parts become per unit length, the better the skin touch becomes. However, if there is too much arrangement number thereof, the water absorption capacity or such deteriorates. If there is too little arrangement number thereof, it is difficult for drops of water attached to the surface to fall in to the side of the concavity parts, so that the water absorption capacity deteriorates.

[0029] The area ratio between the pile parts and the concavity parts can be established in the range of (pile parts) : (concavity parts) = 11:1 to 7:5. By changing this ratio, it becomes possible to adjust the balance between a function such as a touch property or a dry touch of the pile parts and a function of such as water absorption of the concavity parts. If the ratio of the pile parts are too less, a skin makes contact with the bottom of broad concavity parts, so that the dry touch is damaged. If the ratio of the concavity parts are too less, a transfer characteristic of water into the side of a middle ply becomes worse.

[0030] Referring to the difference in unevenness between the pile part and the concavity part, that is to say, the height of the pile part, the height of all pile parts may be the same, or the height can differ between pile parts. In one pile part the height may be the same overall, or the height can differ in part. For example, it becomes possible for water or a drop of water attached to the upper side of the pile part to move smoothly through the lower outer border from the central part to the concavity part by establishing the pile height at the outer border part of the pile part lower than that of the central part. The pile height at the outer border can be established in the range of $1/2$ to $1/4$ compared to that of the central part, preferably in the range of $1/2.5$ to $1/3.5$. In this case, it is usual that such a shape as is getting lower and lower at the outer border with the approach to the edge, that is to say, a slant shape is formed.

[0031] As a means for varying partially the height of the pile part, by using high shrinkage yarn at a part that is desired to be lower than other parts and performing the heating treatment for revealing a shrinkage property after knitting, it becomes possible to lower the pile height of the desired part. High shrinkage polyester yarn can be used as the high shrinkage yarn. Especially, the high shrinkage yarn with the boiling water shrinkage of 25 to 70 % is preferable. The high shrinkage yarn with the boiling water shrinkage of 40 to 60 % is more desirable.

[0032] A processing for preventing water repellency can be given at the pile parts. By performing such a treatment as makes yarn or fiber composing the pile parts difficult to repel water, a processing for preventing water repellency makes it good for water to pass into a middle ply and an under ply. The processing for preventing water repellency is not a treatment which changes a water absorption capacity of a material of yarn in itself. The processing for preventing water repellency is also effective in a middle ply and an under ply, and the whole of knitted goods after knitting can be given the processing for preventing water repellency. A so-called antistatic and water absorbed treatment can be adopted as the processing for preventing water repellency. The antistatic and water absorbed treatment decreases an electrostatic propensity of a fiber, which in its turn makes it easier for water to pass between fibers, so that water absorption capacity of knitted fabrics design increases. In the processing for preventing water repellency, the pile parts are coated or enameled with an agent for preventing water repellency or an antistatic and water absorbed agent, or agents thereof are attached to the pile parts.

[Middle ply]

[0033] A middle ply is a structure that supports the pile design of the outer ply. The middle ply allows water to pass smoothly from the side of the outer ply to the side of an under ply. It is preferably the middle ply having the function of preventing a back flow of water from the side of the under ply to the side of the outer ply.

[0034] A knit design similar to a support structure in usual pile knitted goods can be adopted. For example, sharkskin design, satin design, atlas design or such can be enumerated. In spite of the same knit design as of the outer ply, it becomes possible to make the knit design denser by changing used yarn.

[0035] Yarn of the same material as that of yarn in the outer ply can be used for yarn composing the middle ply. For example, polyester yarn can be used. The thickness of yarn can be adopted in the range of 50 to 250 denier, preferably in the range of 50 to 150 denier. If textured yarn is used, the density between filaments increases, and there is a merit that it is difficult for the effect of the processing for preventing water repellency to disappear in spite of repeating washing. The monofilament denier of the yarn in the middle ply is made thinner than that in the outer ply.

[0036] The yarn density in the middle ply, especially at parts corresponding to concavity parts of the outer ply, that is to say, parts that appear at the surface side, can be established in the range of 36 to 80/inch in course of finished fabric and in the range of 36 to 80/inch in wale of finished fabric. This yarn density is made larger than that of the outer ply. By adopting the yarn density appropriately, water existing at concavity parts in the outer ply is effectively absorbed because of a capillary phenomenon between yarns and fibers in the middle ply, so that water is transported to the side of the under ply. Furthermore, water transported to the side of the under ply is prevented from moving to the side of the outer ply owing to a fiber structure of the middle ply.

[0037] It becomes possible to retain effectively the aforementioned effect of the processing for preventing water repellency in the long term by raising the fiber density composed of fabric of the middle ply. If the fiber density composed of fabric of the middle ply is larger than that of the outer ply, it is difficult for a back flow from the middle ply to the outer ply to occur. In spite of repeating washing many times, it is difficult for the effect of the processing for preventing water repellency to become weak, and a property of water mobility from the outer ply to the middle ply can be retained.

[0038] By adjusting the number of extracted yarn in the middle ply, especially at parts corresponding to concavity parts of the outer ply, that is to say, parts that appear at the surface side, it becomes preferably possible to prevent a solid matter such as a fecal matter from intruding into knitted goods. Once such a solid matter intrudes into knitted goods, it can be easily removed by such a means as washing. The number of extracted yarn is preferably not more than 4, more preferably in the range of 2 to 3, and especially preferably 2.

[Under ply]

[0039] This under ply is not necessarily essential for knitted goods with a function of controlling water absorption of the present invention. In short, this is because the existence of pile parts and concavity parts in the outer ply enables to achieve a desired object and to obtain a desired effect. A water absorption capacity such as a water retention capacity of the whole of knitted goods is remarkably improved by the existence of this under ply.

[0040] Various kinds of knit design can be adopted as a knit design of the under ply, as long as the knit design has see-through portions in it. For example, atlas net design can be adopted. Unevenness is formed at the backside of knitted goods in which the under ply with see-through portions is arranged.

[0041] Yarn similar to yarn of the middle ply can be used for yarn composing the under ply. For example, polyester yarn can be used. The thickness of the yarn can be adopted in the range of 50 to 250 denier, preferably in the range of 50 to 150 denier.

[0042] A flexible transformation property is exhibited, and a shock absorption property in use is improved by having the see-through portions. The see-through portions improve a property of water mobility from the middle ply. The see-through portions have also the function of improving the water retention capacity by preserving water in the see-through portions. When a water absorption pad or such is arranged under knitted goods with the function of controlling water absorption and is used, a back flow of water into the side of the middle ply is inhibited by making up intervals or an air layer between the water absorption pad and the middle ply.

[0043] The shape of the see-through portions can be varied according to a knit design. For example, a rhombic-shaped see-through portion can be arranged before, behind, right and left in a zigzag state by atlas design. A see-through portion with such a shape as hexagon, rectangle, circle and others can be also adopted.

[0044] In the under ply, it becomes possible to make the yarn density of parts neighboring at least to the middle ply larger than that of the middle ply. In this manner, water in the middle ply is effectively transported to the side of the under ply because of a capillary phenomenon caused by the difference in the fiber density.

[Use]

[0045] Knitted goods with a function of controlling water absorption of the present invention can be utilized for various uses which require a function such as water absorption, water retention, prevention of a back flow.

[0046] Specifically, knitted goods of the present invention can be used for a cloth of a part of a diaper for care which touches a skin. In this case, the outer ply having pile parts is arranged at the side of the diaper which touches a skin. A water absorption portion comprising such as a cotton-like water absorption pad, a non weave cloth, and a cotton fabrics can be arranged at the backside of the under ply. Such a cloth as has water porousability can be arranged at the backside of the water absorption portion.

[0047] The application to a cloth of a mat for a bathroom or a cloth for a bed sheet as well is possible. The application to various clothing or life commodities that sweat easily attaches to or that becomes wet easily is possible.

BRIEF DESCRIPTION OF DRAWINGS

[0048] Fig. 1 is a typical perspective view of knitted goods with a function of controlling water absorption which shows

embodiment of the present invention. Fig. 2 is a typical sectional view. Fig. 3 is a typical bottom plan view. Fig. 4 is a typical sectional view which illustrates the structure of a pile part before the shrinkage treatment (a) and after the shrinkage treatment (b). Fig. 5 is a sectional view in use for a diaper for care.

[0049] In Fig. 1 - 5, an outer ply is shown by 10, pile parts (convex parts) are shown by 12, concavity parts (concave parts) are shown by 14, a middle ply is shown by 20, an under ply is shown by 30, a part of straight lines zone is shown by 32, and parts with see-through portions are shown by 34.

BEST MODE FOR CARRYING OUT THE INVENTION

[Outline of structure]

[0050] Embodiments shown in Fig. 1-3 illustrate a typical structure of knitted goods with a function of controlling water absorption.

[0051] Knitted goods F comprises three kinds of structural part of an outer ply 10, a middle ply 20, and an under ply 30 each of which are knitted by use of polyester yarn. The middle ply is composed of two ply 22, the upper ply and the lower ply, and the knitted goods has a four-ply structure as a whole.

[0052] A large number of ring loop types are arranged abreast at the outer ply 10. Pile parts 12 forming a lot of straight ribs and concavity parts 14 comprising a vacant-space-like channel arranged at the middle of the pile parts 12 are arranged abreast alternately.

[0053] The middle ply 20 of a two-ply structure is an almost uniform knitted fabric in whole, and supports the pile parts 12 of the outer ply. In concavity parts 14 of the outer ply 10, the middle ply 20 appears at the surface.

[0054] The under ply 30, as shown in Fig. 3 in detail, forms a lattice structure composed of bias straight line zones which cross with one another. Rhombic see-through portions 34 are composed at the center of a lattice structure. In the part of the see-through portion 34, the middle ply 20 appears at the under side. There are parts where the see-through portions 34 of the under ply 30 and the concavity parts 14 of the outer ply 10 face each other at the surface and the reverse with a middle ply 20 between.

[0055] The aforementioned structure of the knitted goods denotes each ply typically, and in actual knitted goods yarn composing each ply and yarn of neighboring ply becomes tangled with each other, or becomes knitted together. As a result the neighboring ply are mingled in one.

[0056] Fig. 4 shows detailed structure of the pile parts 12 and a method for manufacturing them.

[0057] As shown in Fig. 4 (a), in the pile parts 12 which are in an knitted state, a large number of yarn projecting from the middle ply 20 in a ring form are arranged abreast, and the heights of each ring pile are all the same. However, in the pile parts 12 high shrinkage yarn that has a higher shrinkage property compared with yarn forming other ring loop types is used for yarn 16 of a ring loop type forming both borders.

[0058] As shown in Fig. 4 (b), when the knitted goods after knitting is treated with heating, the ring loop type 16 made up of high shrinkage yarn shrinks much more considerably, so that the height becomes much lower. The whole shape of the pile part 12 is such a shape as forms the difference in level at both borders at the right and left side, or as forms a trapezoid.

[0059] If water makes contact with the surface of the pile part 12 of which the height is low only at an outer border, it becomes easy for water or a drop of water to fall from the low ring pile 16 made up of the high shrinkage yarn to the concavity part 14, so that water or a drop of water is effectively led to the middle ply 20. Furthermore, a skin touch becomes good, because a form without an angle is shaped at the side border of the pile part 12.

[Diaper for care]

[0060] The embodiment shown in Fig. 5 is the case where knitted goods with a function of controlling water absorption having the aforementioned structure is used for a diaper for care.

[0061] Knitted goods F with the function of controlling water absorption comprises the same structure as the aforementioned embodiment.

[0062] The knitted goods cloth F is used at the part of a diaper that touches a skin, a water absorption pad 40 is arranged at the backside of the knitted goods cloth F, and a cloth 50 for covering the reverse which has a property of interception of water flow is arranged at the backside of the water absorption pad 40. The water absorption pad 40 comprises a structure that accommodates in a cotton cloth bag the fiber aggregation having a structure in which cotton yarn is unknitted. A diaper for care can be produced, after these materials are used and typical cutting or knitting processing is gone through.

[0063] In use, the parts that a skin touches are the upper surface of the pile parts 12 in the outer ply 10. A skin touch is not only good, but also has a flexible cushion property at the pile parts 12 in which a nap is raised. The under ply 30 having the see-through portions 34 makes a contribution to raising the flexible cushion property.

[0064] When water such as urine touches the surface, streams of water or drops of water fall in from the side border of the pile parts 12 to the concavity parts 14, and then are absorbed by the middle ply 20, and eventually water is fast absorbed from the see-through portions 34 to the water absorption pad 40. The pile parts 12 give a dry touch to a skin, because drops of water do not remain on the surface of the pile parts 12. Even if the diaper for care is pressed by external pressure such as weight of users and water exudes from the water absorption pad 40, it is possible to prevent water from exuding from the middle ply 20 to the surface side, since spaces are left by the see-through portions 34 of the under ply 30 between the surface of the water absorption pad 40 and the middle ply 20, and an air layer is formed. The yarn density is relatively high in the middle ply 20, and it is impossible for the amount of water within such a limit as enables the exudation of water to pass through the middle ply easily. Since water exuding from the water absorption pad 40 can be saved in the see-through portions 34 of the under ply 30, this effect also makes it difficult for the exudation of water to the surface side to occur.

[0065] Knitted goods cloth F and the water absorption pad 40 making up the diaper for care is capable of washing. Knitted goods cloth F knitted by polyester yarn is superior in durability to washing, and Knitted goods cloth F is not damaged by frequent washing unlike a diaper for care, and knitted goods cloth F dries fast after washing.

EXAMPLES

[0066] Fabrics of Examples and Comparative Examples of the present invention are more specifically knitted, and the results of evaluation thereof are shown below.

[Example 1]

[0067] A warp knit machine (four-bar type) was used. Used yarn and knit design of each reed are shown below.

<Used yarn>

[0068]

Front: Polyester yarn of 100D-24F (4.2 single yarn denier)

Polyester high tenacity yarn produced by Teijin, Ltd.

Tenacity [DRY TENACITY] 7.0±0.7 g/DE

Elongation [DRY ELONGATION] 16.0±4.2 %

Shrinkage [SHRINKAGE] 6.7±1.2 %

Oil Content [OIL CONTENT] 0.50±0.25 %

Middle 2: Polyester yarn of 50D-24F

Middle 1: Polyester yarn of 150D-48F

Back: Polyester yarn of 150D-48F

<Knit design>

[0069]

Front: Sharkskin design (10/56), a ring loop type

Middle 2: Sharkskin design (10/12)

Middle 1: Atlas net design (54/43 · 34/32 · 23/21 · 12/10 · 01/12 · 21/23 · 32/34 · 43/45)

Back: Atlas net design (01/12 · 21/23 · 32/34 · 43/45 · 54/43 · 34/32 · 23/21 · 12/10)

[0070] The front reed, the middle 2 reed, and the middle 1 reed and the back reed correspond to an outer ply, a middle ply, and an under ply respectively. However, because a knit design wove by each reed becomes tangled with together to form knitted goods with a multi-ply structure in one, one ply is not knitted independently by only one reed, each ply is formed by a plurality of reeds in connection with one another.

[0071] The total arrangement number of pile parts and concavity parts per 10 cm in the outer ply was changed variously as shown in the following Table 1. Incidentally, when the total arrangement number is denoted by the aforementioned arrangement interval, the arrangement interval corresponds to (the total arrangement number) / 2 = (the arrangement interval). In the part which corresponds to a concavity part in the middle ply the number of extracted yarn was adjusted in the range of 5 to 7, and the part was formed.

<Table 1>

An article made on an experimental basis	A	B	C	D	E	F
The total number of pile parts + concavity parts	16.5	14.0	12.0	11.5	11.0	10.0

<Processing after knitting>

[0072] After the treatment of raising like a loop type nap, a processing for preventing water repellency was performed by an agent for preventing water repellency.

<Evaluation test>

[0073] A diaper for care with a structure shown in Fig. 5 was produced, and use and washing was repeated.

<Evaluation result >

[0074] When water touched the outer ply of the diaper in use after washing the diaper for care not less than 30 times, a drop of water did not remain on the surface and a dry touch was obtained, because the diaper had the outer ply comprising pile parts and concavity parts. Among the aforementioned article A to F made on an experimental basis, an article D made on an experimental basis had the best capacity.

[0075] Monofilament denier large yarn in the outer ply knitted with the front reed allows the pile to have flexibility. Polyester textured yarn used for the middle reed 1 and the back reed raises a water retention effect. The middle ply knitted with the middle reed 2 exhibits the function of connecting the outer ply with the under ply.

[0076] Incidentally, the processing for preventing water repellency has the effect of improving the formation of a drop of water at a pile part, or mobility in each ply. However, when use and washing is repeated, the function of the processing for preventing water repellency becomes low at the fabric surface. However, in this embodiment if a drop of water is formed at the pile part, a drop of water falls in to the concavity part, so that there are few problems even if the function of the processing for preventing water repellency becomes low. Furthermore, the passage of water is favorably carried out, because it is difficult for the effect of the processing for preventing water repellency in the middle ply and the under ply which does not appear at the surface of knitted goods to become weak. It is thought that the large density between filaments in the middle ply as well is effective in lasting the effect of the processing for preventing water repellency.

[Example 2]

[0077] In an article D made on an experimental basis of Example 1, the number of extracted yarn at the part that corresponds to the concavity part in the middle ply was changed into 2 or 3. The conditions except for the number of an extracted yarn was the same as those of Example 1.

[0078] Articles Da (the number of extracted yarn is 2) and Db (the number of extracted yarn is 3) made on an experimental basis were produced.

[0079] As a result of evaluating capacity, in case of Example 1 a solid matter such as excrement attached to the surface of a diaper for care intruded through the middle ply from the concavity part in the outer ply to the side of a water absorption pad, and the solid matter was often unable to be removed. On the other hand, in Example 2 the intrusion of a solid matter such as excrement could be favorably inhibited. Especially, an article Da made on an experimental basis made better showing.

[0080] In an article Da made on an experimental basis, when the number of course of finished fabric and the number of wale of finished fabric were measured, course was 36 and wale was 36.

[0081] Because such a function of inhibiting the intrusion of a solid matter is a function caused by the structure of a knit design, the effect did not fall in spite of repeating washing.

[Example 3]

[0082] In an article Da made on an experimental basis of Example 2, high-shrinkage polyester yarn of which the boiling water shrinkage rate was 53.2 % was used for yarn provided at the both border of the pile part on the occasion of knitting. The conditions except for it were the same as those of Example 2.

[0083] High shrinkage yarn was shrunk sufficiently by giving high shrinkage yarn the treatment of hot water after knitting.

[0084] In the pile parts of the obtained knitted goods cloth, outer borders in which high shrinkage yarn was used had about one-third as high height as other parts, and had a difference in level.

[0085] When capacity was evaluated, it could be made sure that a drop of water attached to the surface of the pile part very rapidly fell in to the concavity part through the part of the aforementioned difference in level, and that a drop of water was quickly absorbed from the middle ply to a water absorption pad because of a capillary phenomenon. In addition, durability to washing was improved, and practicality was further promoted.

[Comparative Example 1]

[0086] Knitted goods cloth with a two-ply structure was produced.

[0087] The front reed (the outer ply) was provided with polyester of 75D-35F, and the back reed was provided with Bemberg of 50D-38F, and satin design was knitted, and an uniform pile design was knitted on the whole surface of the outer ply. Therefore, in an outer ply there are no difference between the pile parts and the concavity parts.

[0088] The processing for preventing water repellency was performed at the side of the outer ply. Furthermore, the treatment of raising a nap was performed in a pile design.

[0089] When capacity was evaluated after produced knitted goods cloth was allowed to absorb water, a water absorption capacity was good to some degree. However, a pile nap raising property was not good, and a pile did not have flexibility. When the surface was touched after absorption of water, a wet touch was felt.

[Comparative Example 2]

[0090] Knitted goods cloth with a four-ply structure was produced.

Front: An uniform pile design was knitted by sharkskin design by use of polyester of 125D-24F. The pile nap treatment and the process for preventing water repellency similar to that of Comparative Example 1 was performed in the pile part.

Middle 2: Middle 2 was knitted by sharkskin design by use of polyester of 50D-24F.

Middle 1: Middle 1 was knitted by atlas design by use of polyester of 150D-48F.

Back: Back was knitted by atlas design by use of textured yarn of polyester of 150D-48F.

[0091] As a result of evaluating capacity, a water absorption capacity, a dry touch, a pile nap raising property and such exhibited their capacities to some degree. However, handling at the side of the outer ply was rather hard.

[Comparative Example 3]

[0092] For the purpose of comparison with Comparative Example 2, knitted goods structure was made a two-ply structure. The same polyester of 125D-24F as in Comparative Example 1 was used as yarn of the outer ply (front), and polyester of 50D-24F was used in the under ply (back). The pile nap treatment and the process for preventing water repellency was performed similarly.

[0093] As a result of evaluating capacity, a water absorption capacity and a pile nap raising property were good to some degree. However, a wet touch was felt, when the surface was pressed after absorption of water.

[Comparative Example 4]

[0094] In Comparative Example 2, polyester of 100D-24F was used in the outer ply. Furthermore, the nap raising treatment was performed before a dyeing processing, not after a dyeing processing. This was because it had been proved that if the nap raising treatment had been performed after dyeing, a raising agent had remained in a cloth, which had made the effect of the processing for preventing water repellency become weak on the occasion of giving

the treatment of the processing for preventing water repellency. If the nap raising treatment is performed before dyeing, the raising agent is removed in the treatment process of the dyeing processing, so that it is difficult to have a bad influence on the processing for preventing water repellency. The conditions except for the aforementioned conditions were the same as those of Comparative Example 2.

[0095] As a result of evaluating capacity, a water absorption capacity and a pile nap raising property was similar to a water absorption capacity and a pile nap raising property of Comparative Example 3. However, handling of the outer ply became soft, and a dry touch was improved.

[0096] A diaper for care similar to one of Example 1 was produced by using knitted goods cloth of Comparative Example 4. The diaper was used in practice, and its durability was tested.

[0097] As a result of test performed by linen supply trade, the function was good up to 10 times washing. However, a drop of water remained on the surface above 10 times washing, and a feeling in use deteriorated. This was because a drop of water was formed on the pile part by surface tension of water attached to the surface of a diaper and water did not move to ply under the pile part. If the processing for preventing water repellency is given, it becomes difficult to form the aforementioned drop of water and it becomes easy for water to move to lower ply. However, it is thought that the effect of the processing for preventing water repellency disappears, when washing is repeated.

[Capacity Comparison Table]

[0098] The production conditions and capacity evaluation results of the aforementioned Examples and Comparative Examples are compiled and shown in the following Table 2 to 4. Incidentally, data of Example 1 are data of an article (D) made on an experimental basis, and data of Example 2 are data of an article (Da) made on an experimental basis. Table 4 shows detailed data of durability test to washing of Examples 1 to 3 and Comparative Example 4. In a durability test to washing, a water absorption capacity after washing was measured in accordance with JIS Standard L-1018-A (sec) and JIS Standard L-1018-B (mm).

[Table 2]

	Example 1	Example 2	Example 3
The number of ply	4	4	4
Used yarn: Front	100D-24F	100D-24F	100D-24F
: Middle 2	50D-24F	50D-24F	50D-24F
: Middle 1	150D-48Ftex	150D-48Ftex	150D-48Ftex
: Back	150D-48Ftex	150D-48Ftex	150D-48Ftex
Unevenness in an outer ply	Unevenness	Unevenness	Unevenness
Difference in level at a pile part	No existence	No existence	No existence
Time of raising a nap	Before dyeing	Before dyeing	Before dyeing
A dry touch	○	○	○
A pile nap raising property	○	○	○
A water absorption capacity	○	○	○
Handling at the surface	○	○	○
The effect of preventing a back flow	○	○	○
Durability to washing	30 times	40 times	>50 times
Prevention of permeation of a solid matter	×	○	○

[Table 3]

	Comparative Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4
The number of ply	2	4	2	4
Used yam: Front	75D-36F	125D-24F	125D-24F	100D-24F

EP 1 178 140 A1

[Table 3] (continued)

		Comparative Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4
5	2 : Middle	-	50D-24F	-	50D-24F
	1 :Middle	-	150D-48Ftex	-	150D-48Ftex
10	: Back	50D-38F Bemberg	150D-48Ftex	50D-24Ftex	150D-48Ftex
	Unevenness in an outer ply	Flat	Flat	Flat	Flat
15	Difference in level at a pile part	No existence	No existence	No existence	No existence
	Time of raising a nap	After dyeing	After dyeing	After dyeing	Before dyeing
	A dry touch	○	○	×	○
20	A pile nap raising property	×	○	○	○
	A water absorption capacity	○	○	○	○
25	Handling at the surface	×	×	×	○
	The effect of preventing a back flow	×	○	×	○
30	Durability to washing	×	×	×	10 times
35	Prevention of permeation of a solid matter	×	×	×	×

[Table 4]

		Example 1	Example 2	Example 3	Comparative Example 4
40	A water absorption capacity L-10 (sec) L-10(mm)	0/0 180/177	0/0 182/158	0/0 182/158	0/0 180/180
45	L-20 (sec) L-20(mm)	0/0 180/180	0/0 162/139	0/0 162/139	0/0 150/124
	L-30 (sec) L-30(mm)	0/0 180/180	0/0 185/165	0/0 185/165	0/0 132/99
50	L-40 (sec) L-40(mm)	>180/0 180/180	0/0 140/130	0/0 140/130	0/0 143/96
	L-50 (sec) L-50(mm)	>180/0 180/180	>180/0 140/114	>180/0 140/114	0/0 105/82

INDUSTRIAL APPLICABILITY

[0099] Knitted goods with a function of controlling water absorption of the present invention enables to have water making contact with an outer ply fall in from a pile part to a concavity part smoothly, to have water absorbed in a middle

ply rapidly, and to have water move from a see-through portion of an under ply to the backside. The knitted goods also enable to give a dry touch to a skin making contact with a pile part in an outer ply, and becomes superior in a feeling in wear. The function of water absorption does not fall, although washing is repeated. Because the knitted goods do not allow a solid matter except for water to pass, the knitted goods are easy to wash and are superior in a reuse property.

Claims

1. Knitted goods with a function of controlling water absorption, of which the outer ply is a fabric comprising a pile design, with the knitted goods being **characterized by** comprising a large number of convex parts and concave parts, wherein the convex parts and the concave parts are formed by the pile design.
2. Knitted goods according to claim 1, wherein the concave parts include a non-pile design.
3. Knitted goods according to claim 1 or 2, wherein the pile design is knitted by polyester high tenacity yarn of which the monofilament denier is not less than 3.5 and of which the total denier is not less than 100.
4. Knitted goods according to any one of claims 1 to 3, wherein the convex parts and the concave parts are arranged in a ratio of 5 ± 2 in number per 10 cm.
5. Knitted goods according to any one of claims 1 to 4, wherein the area ratio between the convex parts and the concave parts is (convex parts) : (concave parts) = 11:1 to 7:5.
6. Knitted goods according to any one of claims 1 to 5, wherein the shape of a border at the convex parts is such a slant shape as becomes lower with the approach to the edge.
7. Knitted goods according to any one of claims 1 to 6, which comprises a multi-ply structure, wherein an under ply with a large number of see-through portions is arranged at the backside of a middle ply supporting the pile design.
8. Knitted goods according to claim 7, wherein the knit design in the under ply is denser than the knit design in a middle ply.
9. Knitted goods according to claim 7 or 8, wherein the yarn density at parts in the middle ply which correspond to the concave parts in the outer ply is 36-80/inch in course of finished fabric and 36-80/inch in wale of finished fabric.
10. Knitted goods according to any one of claims 7 to 9, wherein the number of extracted yarn of a knit design at parts in the middle ply which correspond to the concave parts in the outer ply is not more than 4.
11. Knitted goods with a function of controlling water absorption, which are knitted goods with a multi-ply structure in which a plurality of knit design ply are piled, including:
 - an outer ply which comprises a pile design, having a large number of convex pile parts and concave parts, wherein the concave parts are arranged between the pile parts;
 - a middle ply which is arranged at the backside of the outer ply and supports the pile part;
 - an under ply which is arranged at the backside of the middle ply and comprises a knit design with a large number of see-through portions.
12. Knitted goods according to claim 11, wherein the pile parts in the outer ply are knitted by polyester high tenacity yarn of which the monofilament denier is not less than 3.5 and of which the total denier is not less than 100.
13. Knitted goods according to claim 11 or 12, wherein the pile parts and the concavity parts in the outer ply are arranged in a ratio of 5 ± 2 in number per 10 cm.
14. Knitted goods according to any one of claims 11 to 13, wherein the area ratio between the pile parts and the concavity parts in the outer ply is (pile parts) (concavity parts) = 11:1 to 7:5.
15. Knitted goods according to any one of claims 11 to 14, wherein the middle ply yarn density at the concavity parts in the outer ply is 36-80/inch in course of finished fabric and 36-80/inch in wale of finished fabric.

EP 1 178 140 A1

16. Knitted goods according to any one of claims 11 to 15, wherein the pile parts in the outer ply have lower pile heights at their respective outer border parts than at their respective central parts.

5 **17.** Knitted goods according to any one of claims 11 to 16, wherein the knit design in the middle ply is denser than the knit design in the outer ply.

18. Knitted goods according to any one of claims 11 to 16, wherein the knit design in the under ply is denser than the knit design in the middle ply.

10 **19.** Knitted goods according to any one of claims 1 to 18, wherein fibers making up the knit design are hydrophobic fibers.

20. Knitted goods according to any one of claims 1 to 19, which is processed to prevent its water repellency.

15

20

25

30

35

40

45

50

55

Fig. 1

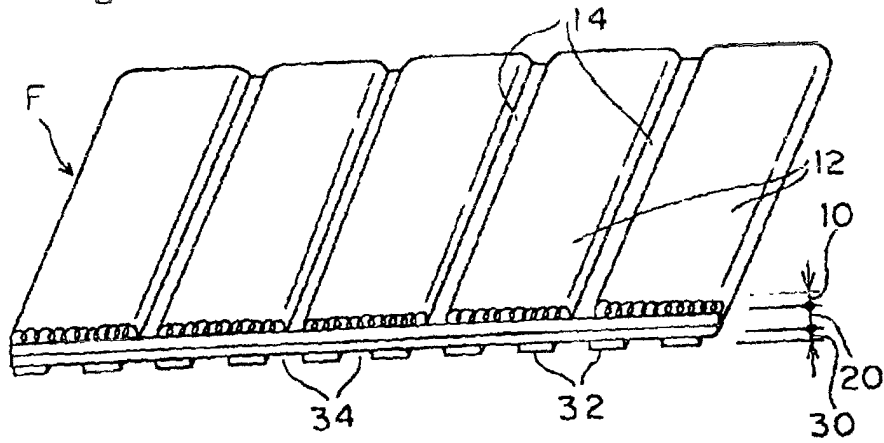


Fig. 2

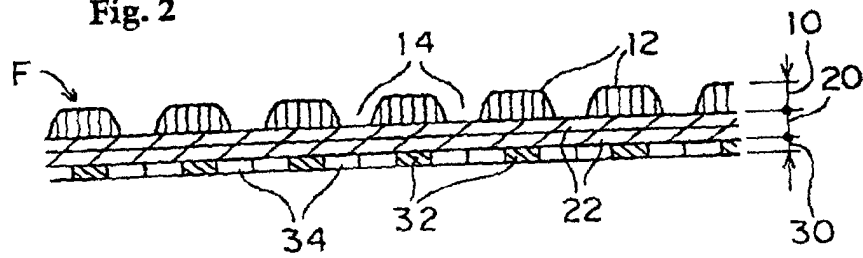


Fig. 3

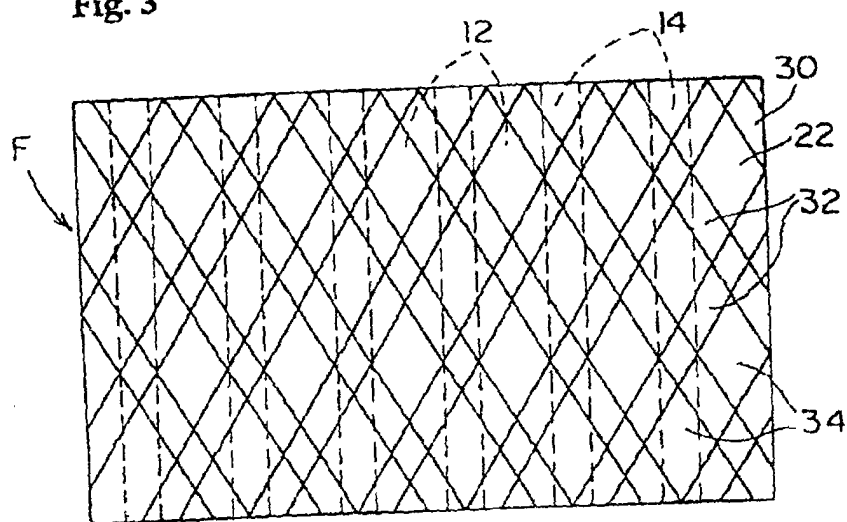


Fig. 4

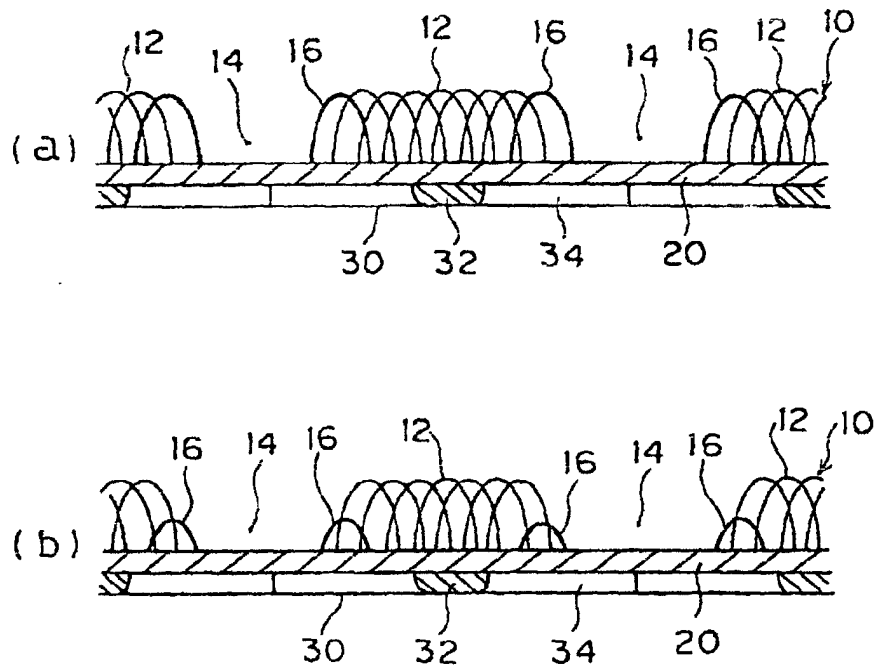
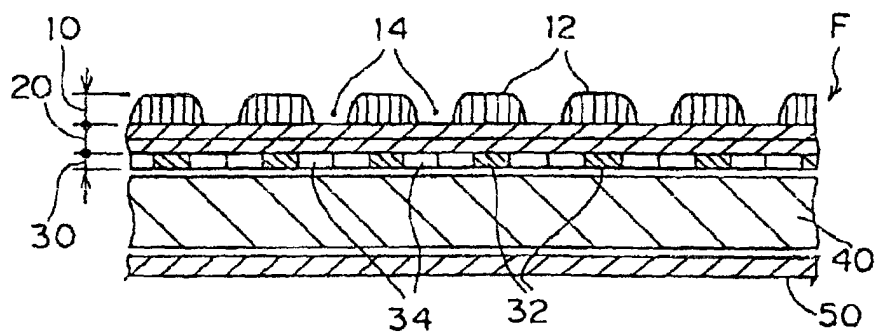


Fig. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP00/01137

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl⁷ D04B1/02, D04B21/02

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl⁷ D04B1/00-1/28, D04B21/00-21/20

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1940-1996 Jitsuyo Shinan Toroku Koho 1996-2000
Kokai Jitsuyo Shinan Koho 1971-1995 Toroku Jitsuyo Shinan Koho 1994-2000

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP, 9-316757, A (Toray Industries, Inc.), 09 December, 1997 (09.12.97) (Family: none)	1-20
Y	JP, 10-219552, A (UNITIKA Ltd.), 18 August, 1998 (18.08.98) (Family: none)	1-20
A	JP, 6-173142, A (Teijin Limited), 21 June, 1994 (21.06.94) (Family: none)	1-20
A	JP, 3013155, U (Ugen Kaisha Seihou), 19 April, 1995 (19.04.95) (Family: none)	1-20
Y	JP, 3-876, A (TOYOBO CO., LTD.), 07 January, 1991 (07.01.91) (Family: none)	20

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search
23 May, 2000 (23.05.00)

Date of mailing of the international search report
13 June, 2000 (13.06.00)

Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.