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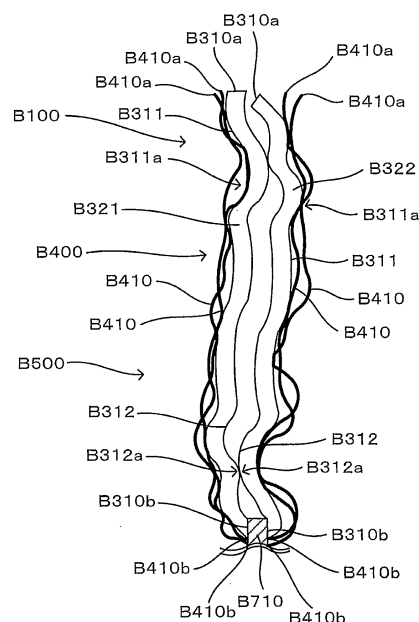
(54) **CLEANING SHEET AND CLEANING INSTRUMENT**

(57) \*\*\*\*\* Following is the English translation of the abstract as filed. However, in WO2016/143147 A1, an English Abstract prepared by the Japanese Patent Office is disclosed. In this connection, please use the appropriate one of the abstracts as originally filed and as made by the JPO, according to your necessity. \*\*\*\*\*

[Object] To provide a more rational constructing technique relating to a structure for providing a space for capturing dust in a cleaning region.

[Solution] Fiber bundle constituent fibers (B410) forming a fiber bundle (B400) and strips (B310) are configured to be bent along a bonding part (B710) so as to be raised up in a direction away from a holding region. It is configured such that, when a first strip (B321) and a second strip (B322) are raised, a first engagement part (B311a) can be engaged with the fiber bundle constituent fibers (B410), and a second engagement part (B312a) of the first strip (B321) and a second engagement part (B312a) of the second strip (B322) can be engaged with each other.

FIG. 8



## Description

### TECHNICAL FIELD

**[0001]** The present invention relates to a cleaning sheet and a cleaning tool for cleaning an object to be cleaned.

### BACKGROUND ART

**[0002]** Japanese Unexamined Patent Application Publication (JP-A) No. 2014-150963 discloses a cleaning sheet configured to be attached to a holder. In the cleaning sheet, a cleaning operation is performed by using a cleaning side sheet having strips and a fiber assembly. Further, in the cleaning operation, the strips and constituent fibers of the fiber assembly are raised, so that a space for capturing dust is provided between the strips and the constituent fibers of the fiber assembly. Specifically, by providing the space for capturing dust in a region of the cleaning sheet which is actually used for cleaning operation, the cleaning sheet has an effective cleaning function.

**[0003]** In forming the space for capturing dust, however, further improvement is desired.

### PRIOR ART DOCUMENT

### PATENT DOCUMENT

**[0004]** Patent Document 1: JP-A No. 2014-150963

### SUMMARY OF THE INVENTION

### PROBLEM TO BE SOLVED BY THE INVENTION

**[0005]** Accordingly, it is an object of the present invention to provide a more rational constructing technique relating to a structure for providing a space for capturing dust in a cleaning region which is actually used for cleaning operation.

### INVENTION TO SOLVE THE PROBLEM

**[0006]** In order to solve the above problem, a cleaning sheet according to the present invention is provided which is configured to be attached to a holder and has a holding region which is attached to the holder and a cleaning region which comes in contact with an object to be cleaned.

**[0007]** The holding region has sheet elements and a receiving part configured to receive the holder and formed by superposing the sheet elements. Specifically, the receiving part is configured to be removably attached to the holder.

**[0008]** The cleaning region has a fiber bundle, a cleaning side sheet-like member superposed on the fiber bundle, and a bonding part that bonds the fiber bundle and

the cleaning side sheet-like member. The fiber bundle is formed by arranging a plurality of fiber bundle constituent fibers having prescribed orientation. The cleaning side sheet-like member has a first surface facing the fiber bundle, a second surface on the side opposite to the first surface, a cut element and a strip element defined by the cut element. The cut element consists of a plurality of cuts. The strip element is formed between adjacent ones of the cuts and has a first strip and a second strip. Further, the strip element has a plurality of strips, and any pair of the strips can be respectively defined as the first strip and the second strip.

**[0009]** The fiber bundle constituent fibers are configured to be bent along the bonding part so as to be raised up in a direction away from the holding region. Each of the first strip and the second strip has a first engagement part formed on the first surface and a second engagement part formed on the second surface and is configured to be bent along the bonding part so as to be raised up in a direction away from the holding region. Specifically, when the fiber bundle constituent fibers and the first and second strips are raised, a space for capturing dust is formed between the fiber bundle constituent fibers and the first and second strips. Further, a user can raise the fiber bundle constituent fibers and the first and second strips by holding both ends of the cleaning sheet with both hands and alternately moving the hands up and down, or by shaking the user's hand holding the holder attached to the cleaning sheet.

**[0010]** With the above-described structure, it is configured such that, when the first and second strips are raised, the first engagement part can be engaged with the fiber bundle constituent fibers and the second engagement part of the first strip and the second engagement part of the second strip can be engaged with each other.

**[0011]** The cleaning sheet according to this invention is raised, while the first engagement parts of the strips are engaged with the fiber bundle constituent fibers and the first and second strips are engaged with each other via the respective second engagement parts. Therefore, particularly in an early stage of a cleaning operation, the raised state of the strips and the fiber bundle constituent fibers can be easily maintained. The term "engagement" or "engage" as used in the present invention is explained. For example, when the cleaning side sheet-like member is a nonwoven fabric, the cleaning side sheet-like member has nonwoven fabric constituent fibers forming the nonwoven fabric. Therefore, the engagement between the first strip and the second strip means that the nonwoven fabric constituent fibers of the first and second strips are entangled with each other. Further, the "engagement" between the strips and the fiber bundle constituent fibers means that the nonwoven fabric constituent fibers of the strips and the fiber bundle constituent fibers are entangled with each other.

**[0012]** In an aspect of the solution in the cleaning sheet according to the present invention, the cleaning side

sheet-like member has a first direction which is defined by a direction from the bonding part toward a free end of the strip element, and a second direction crossing the first direction.

**[0013]** In an aspect of the solution in the cleaning sheet according to the present invention, the cleaning side sheet-like member may be formed of nonwoven fabric. In this case, the nonwoven fabric may have a plurality of nonwoven fabric constituent fibers having orientation in the first direction.

**[0014]** In an aspect of the solution in the cleaning sheet according to the present invention, the first engagement part may be formed of the nonwoven fabric constituent fibers exposed to the first surface. In the cleaning sheet according to this aspect, the nonwoven fabric constituent fibers and the fiber bundle constituent fibers can be engaged with each other.

**[0015]** In an aspect of the solution in the cleaning sheet according to the present invention, the second engagement part may be formed of the nonwoven fabric constituent fibers exposed to the second surface. In the cleaning sheet according to this aspect, the nonwoven fabric constituent fibers of the first strip and the nonwoven fabric constituent fibers of the second strip can be engaged with each other.

**[0016]** In an aspect of the solution in the cleaning sheet according to the present invention, the nonwoven fabric preferably has higher rigidity in the first direction than in the second direction.

**[0017]** In an aspect of the solution in the cleaning sheet according to the present invention, preferably, the nonwoven fabric has rigidity of 69.7 mm to 80.0 mm in the first direction and rigidity of 35.0 mm to 39.9 mm in the second direction.

**[0018]** In an aspect of the solution in the cleaning sheet according to the present invention, the nonwoven fabric preferably has total light transmittance of 83.03 to 88.43 %.

**[0019]** In an aspect of the solution in the cleaning sheet according to the present invention, the nonwoven fabric preferably has a larger average surface friction coefficient in the first direction on the second surface than on the first surface.

**[0020]** In an aspect of the solution in the cleaning sheet according to the present invention, the nonwoven fabric preferably has an average surface friction coefficient of 0.126 to 0.129  $\mu$  in the first direction on the first surface and an average surface friction coefficient of 0.138 to 0.145  $\mu$  in the first direction on the second surface.

**[0021]** In an aspect of the solution in the cleaning sheet according to the present invention, the nonwoven fabric preferably has a larger average surface friction coefficient in the second direction on the second surface than on the first surface.

**[0022]** In an aspect of the solution in the cleaning sheet according to the present invention, the nonwoven fabric preferably has an average surface friction coefficient of 0.136 to 0.137  $\mu$  in the second direction on the first sur-

face and an average surface friction coefficient of 0.145 to 0.163  $\mu$  in the second direction on the second surface.

**[0023]** In an aspect of the solution in the cleaning sheet according to the present invention, the nonwoven fabric preferably has a larger average deviation of surface roughness in the first direction on the second surface than on the first surface.

**[0024]** In an aspect of the solution in the cleaning sheet according to the present invention, the nonwoven fabric preferably has an average deviation of surface roughness of 3.225 to 3.350  $\mu$  in the first direction on the first surface and an average deviation of surface roughness of 3.250 to 3.535  $\mu$  in the first direction on the second surface.

**[0025]** In an aspect of the solution in the cleaning sheet according to the present invention, the sheet element may be a laminate sheet formed by superposing a first sheet-like member and a second sheet-like member one on the other. In this case, the laminate sheet has a first sheet bonding part which bonds the first and second sheet-like members, and a second sheet bonding part which is spaced apart from the first sheet bonding part and bonds the first and second sheet-like members. With this structure, the receiving part may be defined by a space surrounded by the first sheet-like member, the second sheet-like member, the first sheet bonding part and the second sheet bonding part.

**[0026]** In an aspect of the solution in the cleaning sheet according to the present invention, the sheet element may be a single sheet-like member. The sheet-like member has a superposed part formed by superposing regions spaced apart from each other in the sheet-like member one on the other, and a sheet bonding part which bonds the superposed regions of the sheet-like member in the superposed part. With this structure, the receiving part may be defined by a space surrounded by the sheet bonding part and a region of the sheet-like member which extends in a loop between the spaced-apart regions bonded at the sheet bonding part.

**[0027]** In order to solve the above-described problem, a cleaning tool according to the present invention is provided which has a holder and a cleaning sheet attached to the holder. The holder has a grip configured to be held by a user, and a long part connected to the grip. The cleaning sheet has a holding region attached to the long part and a cleaning region which comes in contact with an object to be cleaned.

**[0028]** The holding region has sheet elements and a receiving part configured to receive the holder and formed by superposing the sheet elements. Specifically, the receiving part is configured to be removably attached to the holder.

**[0029]** The cleaning region has a fiber bundle, a cleaning side sheet-like member superposed on the fiber bundle, and a bonding part that bonds the fiber bundle and the cleaning side sheet-like member. The fiber bundle is formed by arranging a plurality of fiber bundle constituent fibers having prescribed orientation. The cleaning side

sheet-like member has a first surface facing the fiber bundle, a second surface on the side opposite to the first surface, a cut element and a strip element defined by the cut element. The cut element consists of a plurality of cuts. The strip element is formed between adjacent ones of the cuts and has a first strip and a second strip. Further, the strip element has a plurality of strips, and any pair of the strips can be respectively defined as the first strip and the second strip.

**[0030]** The fiber bundle constituent fibers are configured to be bent along the bonding part so as to be raised up in a direction away from the holding region. Each of the first and second strips has a first engagement part formed on the first surface and a second engagement part formed on the second surface and is configured to be bent along the bonding part so as to be raised up in a direction away from the holding region. Specifically, when the fiber bundle constituent fibers and the first and second strips are raised, a space for capturing dust is formed between the fiber bundle constituent fibers and the first and second strips. Further, a user can raise the fiber bundle constituent fibers and the first and second strips by holding both ends of the cleaning sheet with both hands and alternately moving the hands up and down, or by shaking the user's hand holding the holder attached to the cleaning sheet.

**[0031]** With the above-described structure, it is configured such that, when the first and second strips are raised, the first engagement part can be engaged with the fiber bundle constituent fibers and the second engagement part of the first strip and the second engagement part of the second strip can be engaged with each other.

**[0032]** In the cleaning tool according to the present invention, the cleaning sheet is raised, while the first engagement parts of the strips are engaged with the fiber bundle constituent fibers and the first and second strips are engaged with each other via the respective second engagement parts. Therefore, particularly in an early stage of a cleaning operation, the raised state of the strips and the fiber bundle constituent fibers can be easily maintained.

#### EFFECT OF THE INVENTION

**[0033]** According to the present invention, a more rational constructing technique relating to a structure for providing a space for capturing dust in a cleaning region is provided.

#### BRIEF DESCRIPTION OF THE DRAWINGS

##### **[0034]**

FIG. 1 is a perspective view showing a cleaning tool according to a first embodiment of the present invention.

FIG. 2 is a plan view showing a holder according to

the first embodiment of the present invention.

FIG. 3 is a plan view showing a cleaning sheet according to the first embodiment of the present invention.

FIG. 4 is a bottom view of the cleaning sheet.

FIG. 5 is a sectional view taken along line II-II in FIG. 3.

FIG. 6 is an explanatory drawing for illustrating a strip element.

FIG. 7 is an explanatory drawing for illustrating the strip element and a fiber bundle.

FIG. 8 is an explanatory drawing for illustrating operation of the strip element and the fiber bundle.

FIG. 9 is an explanatory drawing for illustrating a cleaning sheet according to a second embodiment of the present invention.

#### EMBODIMENTS FOR CARRYING OUT THE INVENTION

##### (Description of First Embodiment)

**[0035]** A first embodiment of the present invention is now described with reference to FIGS. 1 to 8. FIG. 1 is a perspective view showing a cleaning tool A100. As shown in FIG. 1, the cleaning tool A100 includes a holder C100 and a cleaning sheet B100 which is removably attached to the holder C100. The cleaning sheet B100 has a holding region B110 to which the holder C100 is attached. Further, a region of the cleaning sheet B100 which comes in contact with an object to be cleaned forms a cleaning region B120. The cleaning tool A100, the holder C100, the cleaning sheet B100, the holding region B110 and the cleaning region B120 are example embodiments that correspond to the "cleaning tool", the "holder", the "cleaning sheet", the "holding region" and the "cleaning region", respectively, according to the present invention.

**[0036]** The cleaning sheet B100 may be sold alone or sold as the cleaning tool A100 in a package in which the cleaning sheet B100 and the holder C100 are packed together. The cleaning sheet B100 may be of disposable type designed for single use, or disposable type designed for multiple use which can be used several times, while holding dust or dirt collected from a cleaning surface to be cleaned.

**[0037]** The cleaning sheet B100 defines a prescribed cleaning sheet first direction B100y and a cleaning sheet second direction B100x crossing the cleaning sheet first direction B100y. A longitudinal direction of the cleaning sheet B100 coincides with the cleaning sheet first direction B100y.

**[0038]** The holding region B110 extends in the cleaning sheet first direction B100y. Further, in the cleaning sheet first direction B100y, a direction in which the holder C100 is attached to the cleaning sheet B100 defines an inserting direction B100y1 and a direction in which the holder C100 is removed from the cleaning sheet B100 defines

a removing direction B100y2.

**[0039]** An extending direction of the holder C100 is defined by an extending direction of the cleaning sheet B100 when the holder C100 is attached to the cleaning sheet B100. Specifically, a long part C110 of the holder C100 is inserted into a receiving part B600 of the cleaning sheet B100 and extends in the cleaning sheet first direction B100y. Further detailed structures of the cleaning sheet B100 and the holder C100 are described below.

(Description of the Holder)

**[0040]** The holder C100 is now described with reference to FIG. 2. FIG. 2 is a plan view showing the entire holder C100.

**[0041]** As shown in FIG. 2, the holder C100 has the long part C110 which is attached to the holding region B110 of the cleaning sheet B100, and a handle C160 configured to be held by a user. The long part C110 has a front end part C120, a base part C130 and an extending part C140 extending between the front end part C120 and the base part C130. The extending part C140 has a bifurcated form extending from the base part C130. It means that the long part C110 has the single base part C130 and has two extending parts C140 and two front end parts C120. The handle C160 has a front end part C161, a rear end part C162 and a grip C163 extending between the front end part C161 and the rear end part C162. The base part C130 of the long part C110 and the front end part C161 of the handle C160 are configured to be removable from each other. The long part C110 and the grip C163 are example embodiments that correspond to the "long part" and the "grip", respectively, according to the present invention. The holder C100 is formed of resin material.

(Description of the Cleaning Sheet)

**[0042]** A basic structure of the cleaning sheet B100 is explained with reference to FIGS. 3 to 5. FIG. 3 is a plan view showing the cleaning sheet B100, FIG. 4 is a bottom view showing the cleaning sheet B100, and FIG. 5 is a sectional view taken along line II-II in FIG. 3.

**[0043]** First, an overall structure of the cleaning sheet B100 is explained with reference to FIG. 5.

**[0044]** As shown in FIG. 5, the cleaning sheet B100 mainly includes a sheet-like member and a fiber bundle B400. The sheet-like member refers to a first sheet B210, a second sheet B220 and a third sheet B230. Particularly the first sheet B210 and the second sheet B220 form a sheet element for forming the receiving part B600. The first sheet B210 and the second sheet B220 are an example embodiment that corresponds to the "sheet element" according to the present invention.

**[0045]** The first sheet B210 and the second sheet B220 are superposed one on the other. The fiber bundle B400 is disposed between the second sheet B220 and the third sheet B230.

**[0046]** As shown in FIG. 5, the first sheet B210, the second sheet B220, the fiber bundle B400 and the third sheet B230 are bonded together by a first bonding part B710. Further, the first sheet B210, the second sheet B220 and part of the fiber bundle B400 are bonded together by a second bonding part B720. The holding region B110 is formed in a region surrounded by the second bonding part B720 between the first sheet B210 and the second sheet B220. In this sense, it can be said that the first bonding part B710 forms a dividing part for dividing the holding region B110. The first bonding part B710 is an example embodiment that corresponds to the "bonding part" according to the present invention.

**[0047]** In other words, a laminate sheet formed by superposing the first and second sheets B210, B220 one on the other is bonded by a pair of second bonding parts B720. Further, the second bonding parts B720 are arranged apart from each other. The pair second bonding parts B720 are example embodiments that correspond to the "first sheet bonding part" and the "second sheet bonding part" according to the present invention. Thus, it can be said that the receiving part B600 is defined by a space surrounded by the first sheet B210, the second sheet B220 and the pair second bonding parts B720. The receiving part B600, the first sheet B210 and the second sheet B220 are example embodiments that correspond to the "receiving part", the "first sheet-like member" and the "second sheet-like member", respectively, according to the present invention. Further, the receiving part B600 is divided by the first bonding part B710.

**[0048]** The cleaning region B120 includes both end regions of the first sheet B210 and the second sheet B220 in the cleaning sheet first direction B100y, both end regions of the first sheet B210 and the second sheet B220 in the cleaning sheet second direction B100x, the fiber bundle B400 and the third sheet B230. Particularly, the fiber bundle B400 and the third sheet B230 form a brush part B500 which is held in contact with a region to be cleaned by a user during cleaning operation. The third sheet B230 and the fiber bundle B400 are example embodiments that correspond to the "cleaning side sheet-like member" and the "fiber bundle", respectively, according to the present invention.

**[0049]** Further, the cleaning sheet B100 according to the first embodiment has the brush part B500 only on the second sheet B220 side. However, the brush part B500 may be formed on both sides of the receiving part B600 by bonding the fiber bundle B400 on both the first sheet B210 side and the second sheet B220 side.

**[0050]** As shown in FIG. 3, the receiving part B600 has openings B610 on its both ends. The long part C110 of the holder C100 can be inserted from either of the openings B610. As shown in FIG. 3, the first sheet B210 is formed to be shorter than the second sheet B220 in the cleaning sheet first direction B100y. The first and second sheets B210, B220 have a plurality of cuts B331 extending in the cleaning sheet second direction B100x. Further, as shown in FIG. 4, the third sheet B230 also has a plu-

rality of cuts B331 extending in the cleaning sheet second direction B100x. Strips B310 are formed between the adjacent cuts B331 in the first, second and third sheets B210, B220, B230. The strips B310 are brought in contact with the object to be cleaned by the user so as to perform a function of scraping dust.

**[0051]** In other words, as shown in FIGS. 3 and 4, each of the first, second and third sheets B210, B220, B230 has a cut element B330 and a strip element B300 defined by the cut element B330. It can be said that the cut element B330 consists of a plurality of the cuts B331 and the strip element B300 is formed between adjacent ones of the cuts B331. With this structure, the strip element B300 consists of a plurality of the strips B310.

**[0052]** The cut element B330, the strip element B300 and the cut B331 are example embodiments that correspond to the "cut element", the "strip element" and the "cut", respectively, according to the present invention.

**[0053]** The first, second and third sheets B210, B220, B230 are formed of flexible nonwoven fabric or other similar materials. The first, second and third sheets B210, B220, B230 which are welded by the bonding parts B710, B720 are preferably formed of nonwoven fabric of thermal melting fibers (thermoplastic fibers). Next, structures of the first, second and third sheets B210, B220, B230 are explained.

**[0054]** The first and second sheets B210, B220 may be formed of any material having a sufficient strength for use, such as nonwoven fabric, resin film and cloth containing synthetic fibers. Particularly, in terms of the strength, through-air nonwoven fabric is preferably used which has a basis weight of 10 to 100 gsm and is formed of conjugated fibers having a core of polyethylene terephthalate and a sheath of polyethylene.

**[0055]** The third sheet B230 may be formed of any material having a sufficient strength for use, such as nonwoven fabric, resin film and cloth containing synthetic fibers. When the third sheet B230 is formed of nonwoven fabric, particularly in terms of the strength, through-air nonwoven fabric is preferably used which has a basis weight of under 30 gsm and is formed of conjugated fibers having a core of polyethylene terephthalate and a sheath of polyethylene. In this case, the third sheet B230 is preferably formed to have a lighter basis weight than the first and second sheets B210, B220. With such a structure, the third sheet B230 can be formed to be lighter and more flexible than the first and second sheets B210, B220. As a result, as described below, the strips B310 of the third sheet B230 can be satisfactorily raised.

**[0056]** Next, structures of the third sheet B230 and the fiber bundle B400 are explained with reference to FIGS. 6 and 7. FIG. 6 is an explanatory view showing the strip element B300 and FIG. 7 is an explanatory view showing the strip element and the fiber bundle.

**[0057]** As shown in FIG. 6, the third sheet B230 has a strip first direction B310y which is defined by a direction from the first bonding part B710 toward a free end of the strip element B300, and a strip second direction B310x

crossing the strip first direction B310y. The strip first direction B310y and the strip second direction B310x are example embodiments that correspond to the "first direction" and the "second direction", respectively, according to the present invention.

**[0058]** As shown in FIG. 6, the strip B310 has a connected end B310b on the first bonding part B710 side and a free end B310a on the side opposite to the connected end B310b in the strip first direction B310y. Further, a pair of the strips B310 which are opposed to each other on the opposite sides of the first bonding part B710 are defined as a first strip B321 and a second strip B322, respectively. The first strip B321 and the second strip B322 are example embodiments that correspond to the "first strip" and the "second strip", respectively, according to the present invention.

**[0059]** When the third sheet B230 is formed of nonwoven fabric, fibers forming the nonwoven fabric are referred to as nonwoven fabric constituent fibers B231. The nonwoven fabric constituent fiber B231 is an example embodiment that corresponds to the "nonwoven fabric constituent fiber" according to the present invention. The nonwoven fabric constituent fibers B231 are shown only in FIG. 7 for convenience of explanation. The nonwoven fabric constituent fibers B231 are arranged to have orientation in the strip first direction B310y.

**[0060]** Further, as shown in FIG. 7, a plurality of fiber bundle constituent fibers B410 having prescribed orientation are arranged to form the fiber bundle B400. More specifically, the fiber bundle constituent fibers B410 have orientation in the strip first direction B310y. Further, as described below, the strips B310 and the fiber bundle constituent fibers B410 are deformed by cleaning operation. Therefore, the state in which the fiber bundle constituent fibers B410 have orientation in the strip first direction B310y refers to the state in which the strips B310 and the fiber bundle constituent fibers B410 are not yet moved or deformed, or the state of the fiber bundle constituent fibers B410 in design. The fiber bundle constituent fiber B410 is an example embodiment that corresponds to the "fiber bundle constituent fiber" according to the present invention.

**[0061]** The fiber bundle constituent fiber B410 has a connected end B410b on the first bonding part B710 side and a free end B410a on the side opposite to the connected end B410b.

**[0062]** The fiber bundle constituent fiber B410 represents a structure formed of "fibers". In this invention, the "fibers" include a typical single fiber, and typical fibers aligned in the length direction and/or the radial direction (twist yarn, spun yarn, yarn to which a plurality of filaments are partially connected). The "typical fibers" as used herein are components of yarn, textile or the like and thin and flexible fibers having a substantially longer length compared with the thickness. Specifically, a long continuous fiber is defined as a filament and a short fiber as a staple. With this structure, the fiber bundle constituent fibers B410 have flexibility.

**[0063]** More specifically, the fiber bundle B400 is an assembly of the fiber bundle constituent fibers B410 which are manufactured from polyethylene, polypropylene, polyethylene terephthalate, nylon, rayon or the like. Generally, a so-called tow can be used as the fiber bundle constituent fibers B410. In this case, it is preferred that the fiber bundle constituent fibers B410 have a fineness of 0.5 to 66 dtex and are crimped fibers having 5 to 30 crimps per inch. It is further preferred that the fiber bundle constituent fibers B410 are conjugated fibers having a core of polyethylene terephthalate and a core covering sheath of polyethylene.

**[0064]** Further, in order to enhance the dust collecting function, liquid paraffin is applied to the fiber bundle B400.

**[0065]** As shown in FIG. 7, the third sheet B230 has a first surface B311 facing the fiber bundle B400 and a second surface B312 on the side opposite to the first surface B311. The first surface B311 and the second surface B312 are example embodiments that correspond to the "first surface" and the "second surface", respectively, according to the present invention. As described above, the fiber bundle constituent fibers B410 and the strips B310 are flexible. Therefore, the fiber bundle constituent fibers B410 and the strips B310 are configured to be bent along the first bonding part B710 so as to be raised up in a direction away from the holding region B110.

**[0066]** As shown in FIG. 7, the strips B310 each have a first engagement part B311a formed on the first surface B311 and a second engagement part B312a formed on the second surface B312. The first engagement part B311a and the second engagement part B312a are example embodiments that correspond to the "first engagement part" and the "second engagement part", respectively, according to the present invention.

**[0067]** The first engagement part B311a is formed by the nonwoven fabric constituent fibers B231 exposed to the first surface B311, and the second engagement part B312a is formed by the nonwoven fabric constituent fibers B231 exposed to the second surface B312.

**[0068]** Then, operation of the cleaning tool A100 according to the first embodiment of the present invention is explained with reference to FIG. 8. In use of the cleaning tool A100, a user raises the strips B310 and the fiber bundle constituent fibers B410 of the cleaning sheet B100. For this purpose, for example, the user holds both ends of the cleaning sheet B100 in the cleaning sheet first direction B100y with both hands and alternately moves the ends up and down, and thereafter attaches the holder C100 to the cleaning sheet B100. Alternatively, the cleaning sheet B100 can also be raised by shaking up and down the user's hand holding the grip C163 of the holder C100 attached to the cleaning sheet B100.

**[0069]** FIG. 8 shows the raised state of the strips B310 and the fiber bundle constituent fibers B410. Further, for the sake of explanation, only the first strip B321, the second strip B322 and part of the fiber bundle constituent fibers B410 are shown in FIG. 8.

**[0070]** When the first strip B321 and the second strip B322 are raised, the first engagement part B311a is engaged with the fiber bundle constituent fibers B410. At this time, the first engagement part B311a and the fiber bundle constituent fibers B410 are required only to be partially engaged with each other, but not to be wholly engaged with each other.

**[0071]** Further, the second engagement part B312a of the first strip B321 and the second engagement part B312a of the second strip B322 are engaged with each other. At this time, the second engagement parts B312a of the two strips B310 are required only to be partially engaged with each other, but not to be wholly engaged with each other.

**[0072]** In the cleaning tool A100 according to the first embodiment of the present invention, when the strips B310 and the fiber bundle constituent fibers B410 are raised, the strips B310 and the fiber bundle constituent fibers B410 are engaged with each other and the strips B310 are engaged with each other. Therefore, the strips B310 and the fiber bundle constituent fibers B410 which form the brush part B500 can be efficiently raised. As a result, particularly in an early stage of a cleaning operation, a space for capturing dust can be suitably secured between the strips B310 and the fiber bundle constituent fibers B410. Further, the volume of the brush part B500 is increased in appearance, which can provide the user with higher expectations for efficient cleaning operation.

(Description of Preferable Third Sheet)

**[0073]** Inventors have confirmed that a preferable structure of the nonwoven fabric forming the third sheet B230 includes the following physical properties in order to raise the strips B310 and the fiber bundle constituent fibers B410 as described above. Further, the nonwoven fabric constituent fibers B231 preferably have orientation in the strip first direction B310y.

**[0074]** In order to raise the third sheet B230, it is preferred that the nonwoven fabric has low rigidity. Specifically, the third sheet B230 is preferably formed of nonwoven fabric having rigidity of 69.7 to 80.0 mm in the first direction and rigidity of 35.0 to 39.9 mm in the second direction. Further, the rigidity is measured according to JIS L 8.21 bending resistance (cantilever A method). Thus, it is preferred that the third sheet B230 has higher rigidity in the first direction than in the second direction.

**[0075]** In order to form the first and second engagement parts B311a, B312a, it is necessary to appropriately arrange the nonwoven fabric constituent fibers B231 on the first and second surfaces B311, B312. This structure can be achieved by increasing the distance between the nonwoven fabric constituent fibers B231 adjacent to each other. This increase means that the total light transmittance of the nonwoven fabric increases.

**[0076]** Specifically, the total light transmittance of the third sheet B230 is preferably 80% or more. More specifically, it is preferred that the third sheet B230 is formed

of nonwoven fabric having a total light transmittance of 83.03 to 88.43%. Further, the total light transmittance is measured in accordance with JIS-K7105. More specifically, it was measured by a color difference meter Z-300A of light irradiation photometric system of Nippon Den-shoku Industries Co., Ltd. domiciled at 4-45-17 Sengoku, Bunkyo-ku, Tokyo, Japan.

**[0077]** In view of the functions exhibited by the first and second engagement parts B311a, B312a, it is preferred that an average friction coefficient of the second surface B312 in the strip first direction B310y is larger than that of the first surface B311 in the strip second direction B310x. With this structure, the strips B310 can be engaged with each other in a satisfactory manner. Specifically, the fiber bundle constituent fibers B410 engage with the strips B310 which are engaged with each other in a satisfactory manner, so that the reliability of raising the strips B310 and the fiber bundle constituent fibers B410 is improved.

**[0078]** Further, in order to prevent the strips B310 engaged with each other from being displaced from each other in the cleaning sheet first direction B100y, it is preferred that an average surface friction coefficient of the second surface B312 in the strip second direction B310x is larger than that of the first surface B311 in the strip second direction B310x.

**[0079]** In this sense, the third sheet B230 is preferably formed of nonwoven fabric having an average surface friction coefficient of 0.126 to 0.129  $\mu$  in the strip first direction B310y on the first surface B311 and an average surface friction coefficient of 0.138 to 0.145  $\mu$  in the strip first direction B310y on the second surface B312.

**[0080]** Further, the third sheet B230 is preferably formed of nonwoven fabric having an average surface friction coefficient of 0.136 to 0.137  $\mu$  in the strip second direction B310x on the first surface B311 and an average surface friction coefficient of 0.145 to 0.163  $\mu$  in the strip second direction B310x on the second surface B312.

**[0081]** Further, the average surface friction coefficient was evaluated by using KES-FB4 of Kato Tech Co., Ltd. domiciled at 26 Karato-cho, Nishikujo, Minami-ku, Kyoto, Japan. The measurement was conducted on a sample of nonwoven fabric having a size of 100 mm x 100 mm under a tension of 400 g, a friction static load of 50 g and a roughness static load of 10g at a standard speed of 1 mm per second.

**[0082]** In order to improve the reliability of engagement between the strips B310 and the fiber bundle constituent fibers B410 and between the strips B310, it is preferred that the third sheet B230 has a rough surface. In this sense, it is preferred that the third sheet B230 is a nonwoven fabric having an average deviation of surface roughness of 3.225 to 3.350  $\mu$  in the strip first direction B310y on the first surface B311 and having an average deviation of surface roughness of 3.250 to 3.535  $\mu$  in the strip first direction B310y on the second surface B312. Thus, it is preferred that the third sheet B230 is configured such that the average deviation of surface roughness in

the strip first direction B310y on the second surface B312 is larger than that on the first surface B311.

**[0083]** Further, the average deviation of surface roughness was evaluated by using KES-FB4 of Kato Tech Co., Ltd.. The measurement was conducted on a sample of nonwoven fabric having a size of 100 mm x 100 mm under a tension of 400 g, a friction static load of 50 g and a roughness static load of 10 g at a standard speed of 1 mm per second.

**[0084]** Based on the above-mentioned conditions of a suitable nonwoven fabric for the third sheet B230, the cleaning sheet B100 having the following cleaning region B120 was prepared.

(Structure of the Cleaning Region B120 in Example)

**[0085]**

- The nonwoven fabric constituent fibers B231 are conjugated fibers having a core of polyethylene terephthalate and a core covering sheath of polyethylene, and has a fineness of 3.2 dtex and an average fiber length of 39 mm.
- The nonwoven fabric has a basis weight of 20 gsm.
- The nonwoven fabric is manufactured by through-air bonding.
- The fiber bundle B400 is obtained by arranging about 37,500 fiber bundle constituent fibers B410 each having a fineness of 3.3 dtex (total fineness of about 124,000 dtex).

(Structure of the Cleaning Region B120 in Comparative Example)

**[0086]**

- The nonwoven fabric constituent fibers B231 are conjugated fibers having a core of polyethylene terephthalate and a core covering sheath of polyethylene. The conjugated fibers consist of 35 % of fibers having a fineness of 2.2 dtex and an average fiber length of 51 mm, and 65 % of fibers having a fineness of 2.8 dtex and an average fiber length of 45 mm.
- The nonwoven fabric has a basis weight of 30 gsm.
- The nonwoven fabric is manufactured by through-air bonding.
- The fiber bundle B400 is obtained by arranging about 31,250 fiber bundle constituent fibers B410 each having a fineness of 3.5 dtex (total fineness of about 110,000 dtex).

**[0087]** In the cleaning sheet B100 having the above-described cleaning region B120 in the example and the cleaning sheet having the above-described cleaning region in the comparative example, the strips and the fiber bundle constituent fibers were raised under the same conditions and then the results were visually checked. As a result, it was confirmed that the cleaning sheet B100

in the example can be more satisfactorily raised than the cleaning sheet in the comparative example.

**[0088]** Further, assuming an actual product, the size of the third sheet B230 corresponding to seven strip sheets arranged in the strip second direction B310x was set to 40 mm square. The nonwoven fabrics of the example and the comparative example were prepared in such a manner as to meet the above-described conditions, and the thicknesses of the nonwoven fabrics were measured. The measurement was conducted by using a PEACOCK measuring instrument of Ozaki Mfg. Co., Ltd. domiciled at 1-63-11 Tokiwadai, Itabashi-ku, Tokyo, Japan. The PEACOCK measuring instrument has a measuring surface having a diameter of 44 mm and the measuring pressure is 3 g/cm<sup>2</sup>.

**[0089]** The result showed that the nonwoven fabric of the example has a thickness of 0.315 mm and the nonwoven fabric of the comparative example has a thickness of 0.6052 mm.

**[0090]** Thus, it is confirmed that the nonwoven fabric of the example is preferably thinner than the nonwoven fabric of the comparative example. Further, the basis weight of the nonwoven fabric of the example is lower than that of the nonwoven fabric of the comparative example, so that it is confirmed that a thinner and lighter nonwoven fabric is suitable to obtain an excellent raised state of the strips B310.

(Description of Second Embodiment)

**[0091]** A cleaning tool A100 according to a second embodiment of the present invention is now explained with reference to FIG. 9. In the cleaning tool A100 according to the second embodiment, components or elements having the same structures and functions as those in the cleaning tool A100 of the first embodiment are given like numerals as in the first embodiment, and they are not described here.

**[0092]** The cleaning tool A100 of the second embodiment is different from the cleaning tool A100 of the first embodiment in the structure of the holding region B110. Specifically, in the cleaning tool A100 of the second embodiment, the receiving part B600 is formed only by the first sheet B210. The first sheet B210 is an example embodiment that corresponds to the "single sheet-like member" according to the present invention.

**[0093]** As shown in FIG. 9, the first sheet B210 has a superposed part formed by superposing regions spaced apart from each other in the first sheet B210 one on the other. The superposed regions of the first sheet B210 are bonded by a bonding part B730 in the superposed part. The bonding part B730 is an example embodiment that corresponds to the "sheet bonding part" according to the present invention. With this structure, the receiving part B600 is defined by a space surrounded by the bonding part B730 and a region of the first sheet B210 which extends in a loop between the spaced-apart regions bonded at the bonding part B730.

**[0094]** In the cleaning tool A100 according to the second embodiment, the extending part C140 of the holder C100 can be attached to the receiving part B600. Further, the cleaning region B120 has the same structure as that of the first embodiment, so that the same effect as the first embodiment can be obtained in raising the strips B310 and the fiber bundle constituent fibers B410.

(Correspondences between the features of the embodiments and the features of the invention)

**[0095]** The cleaning tool A100 is an example embodiment that corresponds to the "cleaning tool" according to the present invention. The holder C100 is an example embodiment that corresponds to the "holder" according to the present invention. The cleaning sheet B100 is an example embodiment that corresponds to the "cleaning sheet" according to the present invention. The holding region B110 is an example embodiment that corresponds to the "holding region" according to the present invention. The cleaning region B120 is an example embodiment that corresponds to the "cleaning region" according to the present invention. The long part C110 is an example embodiment that corresponds to the "long part" according to the present invention. The grip C163 is an example embodiment that corresponds to the "grip" according to the present invention. The first sheet B210 and the second sheet B220 are an example embodiment that corresponds to the "sheet element" according to the present invention. The first bonding part B710 is an example embodiment that corresponds to the "bonding part" according to the present invention. A pair of second bonding parts B720 is an example embodiment that corresponds to the "first sheet bonding part" and the "second sheet bonding part" according to the present invention. The first sheet B210 is an example embodiment that corresponds to the "first sheet-like member" according to the present invention. The second sheet B220 is an example embodiment that corresponds to the "second sheet-like member" according to the present invention. The receiving part B600 is an example embodiment that corresponds to the "receiving part" according to the present invention. The third sheet B230 is an example embodiment that corresponds to the "cleaning side sheet-like member" according to the present invention. The fiber bundle B400 is an example embodiment that corresponds to the "fiber bundle" according to the present invention. The cut element B330 is an example embodiment that corresponds to the "cut element" according to the present invention. The strip element B300 is an example embodiment that corresponds to the "strip element" according to the present invention. The cut B310 is an example embodiment that corresponds to the "cut" according to the present invention. The strip first direction B310y is an example embodiment that corresponds to the "first direction" according to the present invention. The strip second direction B310x is an example embodiment that corresponds to the "second direction" according to the present

invention. The first strip B321 is an example embodiment that corresponds to the "first strip" according to the present invention. The second strip B322 is an example embodiment that corresponds to the "second strip" according to the present invention. The nonwoven fabric constituent fiber B231 is an example embodiment that corresponds to the "nonwoven fabric constituent fiber" according to the present invention. The fiber bundle constituent fiber B410 is an example embodiment that corresponds to the "fiber bundle constituent fiber" according to the present invention. The first surface B311 is an example embodiment that corresponds to the "first surface" according to the present invention. The second surface B312 is an example embodiment that corresponds to the "second surface" according to the present invention. The first engagement part B311a is an example embodiment that corresponds to the "first engagement part" according to the present invention. The second engagement part B312a is an example embodiment that corresponds to the "second engagement part" according to the present invention. The first sheet B210 is an example embodiment that corresponds to the "single sheet-like member" according to the present invention. The bonding part B730 is an example embodiment that corresponds to the "sheet bonding part" according to the present invention.

#### Description of the Numerals

##### [0096]

A100 cleaning tool  
 B100 cleaning sheet  
 B100x cleaning sheet second direction  
 B100y cleaning sheet first direction  
 B100y1 inserting direction  
 B100y2 removing direction  
 B110 holding region  
 B120 cleaning region  
 B210 first sheet (sheet element, first sheet-like member)  
 B220 second sheet (sheet element, second sheet-like member)  
 B230 third sheet (cleaning side sheet-like member)  
 B231 nonwoven fabric constituent fiber  
 B300 strip element  
 B310 strip  
 B310a free end  
 B310b connected end  
 B310x strip second direction (second direction)  
 B310y strip first direction (first direction)  
 B311 first surface  
 B311a first engagement part  
 B312 second surface  
 B312a second engagement part  
 B321 first strip  
 B322 second strip  
 B330 cut element  
 B331 cut

B400 fiber bundle  
 B410 fiber bundle constituent fiber  
 B410a free end  
 B410b connected end  
 B500 brush part  
 B600 receiving part  
 B610 opening  
 B710 first bonding part (bonding part)  
 B720 second bonding part (first sheet bonding part, second sheet bonding part)  
 B730 bonding part (sheet bonding part)  
 C100 holder  
 C110 long part  
 C120 front end part  
 C130 base part  
 C140 extending part  
 C141 first extending part  
 C142 second extending part  
 C151 front end side projection  
 C152 base side projection  
 C160 handle  
 C161 front end part  
 C162 rear end part  
 C163 grip

#### Claims

1. A cleaning sheet configured to be attached to a holder, comprising:

a holding region which is attached to the holder, and  
 a cleaning region which comes in contact with an object to be cleaned, wherein:

the holding region has sheet elements and a receiving part configured to receive the holder and formed by superposing the sheet elements,  
 the cleaning region has a fiber bundle, a cleaning side sheet-like member superposed on the fiber bundle, and a bonding part that bonds the fiber bundle and the cleaning side sheet-like member,  
 the fiber bundle is formed by arranging a plurality of fiber bundle constituent fibers having prescribed orientation,  
 the cleaning side sheet-like member has a first surface facing the fiber bundle, a second surface on the side opposite to the first surface, a cut element and a strip element defined by the cut element,  
 the cut element comprises a plurality of cuts, the strip element is formed between adjacent ones of the cuts and has a first strip and a second strip,  
 the fiber bundle constituent fibers are con-

- figured to be bent along the bonding part so as to be raised up in a direction away from the holding region,  
 each of the first strip and the second strip has a first engagement part formed on the first surface and a second engagement part formed on the second surface and is configured to be bent along the bonding part so as to be raised up in a direction away from the holding region, and  
 when the first strip and the second strip are raised, the first engagement part can be engaged with the fiber bundle constituent fibers, and the second engagement part of the first strip and the second engagement part of the second strip can be engaged with each other,.
2. The cleaning sheet as defined in claim 1, wherein the cleaning side sheet-like member has a first direction that is defined by a direction from the bonding part toward a free end of the strip element, and a second direction crossing the first direction.
  3. The cleaning sheet as defined in claim 1 or 2, wherein the cleaning side sheet-like member is formed of nonwoven fabric and the nonwoven fabric has a plurality of nonwoven fabric constituent fibers having orientation in the first direction.
  4. The cleaning sheet as defined in claim 3, wherein the first engagement part is formed of the nonwoven fabric constituent fibers exposed to the first surface.
  5. The cleaning sheet as defined in claim 3 or 4, wherein the second engagement part is formed of the nonwoven fabric constituent fibers exposed to the second surface.
  6. The cleaning sheet as defined in any one of claims 3 to 5, wherein the nonwoven fabric has higher rigidity in the first direction than in the second direction.
  7. The cleaning sheet as defined in any one of claims 3 to 6, wherein the nonwoven fabric has rigidity of 69.7 to 80.0 mm in the first direction and rigidity of 35.0 to 39.9 mm in the second direction.
  8. The cleaning sheet as defined in any one of claims 3 to 7, wherein the nonwoven fabric has total light transmittance of 83 % or more.
  9. The cleaning sheet as defined in any one of claims 3 to 8, wherein the nonwoven fabric has total light transmittance of 83.03 to 88.43 %.
  10. The cleaning sheet as defined in any one of claims 3 to 9, wherein the nonwoven fabric has a larger average surface friction coefficient in the first direction on the second surface than on the first surface .
  11. The cleaning sheet as defined in any one of claims 3 to 10, wherein the nonwoven fabric has an average surface friction coefficient of 0.126 to 0.129  $\mu$  in the first direction on the first surface and an average surface friction coefficient of 0.138 to 0.145  $\mu$  in the first direction on the second surface.
  12. The cleaning sheet as defined in any one of claims 3 to 11, wherein the nonwoven fabric has a larger average surface friction coefficient in the second direction on the second surface than on the first surface.
  13. The cleaning sheet as defined in any one of claims 3 to 12, wherein the nonwoven fabric has an average surface friction coefficient of 0.136 to 0.137  $\mu$  in the second direction on the first surface and an average surface friction coefficient of 0.145 to 0.163  $\mu$  in the second direction on the second surface.
  14. The cleaning sheet as defined in any one of claims 3 to 13, wherein the nonwoven fabric has a larger average deviation of surface roughness in the first direction on the second surface than on the first surface.
  15. The cleaning sheet as defined in any one of claims 3 to 14, wherein the nonwoven fabric has an average deviation of surface roughness of 3.225 to 3.350  $\mu$  in the first direction on the first surface and an average deviation of surface roughness of 3.250 to 3.535  $\mu$  in the first direction on the second surface.
  16. The cleaning sheet as defined in any one of claims 1 to 15, wherein the sheet element comprises a laminate sheet formed by superposing a first sheet-like member and a second sheet-like member one on the other,  
 the laminate sheet has a first sheet bonding part that bonds the first sheet-like member and the second sheet-like member, and a second sheet bonding part that is spaced apart from the first sheet bonding part and bonds the first sheet-like member and the second sheet-like member, and  
 the receiving part comprises a space surrounded by the first sheet-like member, the second sheet-like member, the first sheet bonding part and the second sheet bonding part.
  17. The cleaning sheet as defined in any one of claims 1 to 16, wherein:  
 the sheet element comprises a single sheet-like member,  
 the sheet-like member has a superposed part

formed by superposing regions spaced apart from each other in the sheet-like member one on the other, and a sheet bonding part that bonds the superposed regions of the sheet-like member in the superposed part, and  
 5  
 the receiving part comprises a space surrounded by the sheet bonding part and a region of the sheet-like member which extends in a loop between the spaced-apart regions bonded at the sheet bonding part.  
 10

**18.** A cleaning tool, having a holder and a cleaning sheet attached to the holder, wherein:

the holder has a grip configured to be held by a user, and a long part connected to the grip,  
 15  
 the cleaning sheet has a holding region attached to the long part and a cleaning region which comes in contact with an object to be cleaned,  
 20  
 the holding region has sheet elements and a receiving part configured to receive the long part and formed by superposing the sheet elements,  
 25  
 the cleaning region has a fiber bundle, a cleaning side sheet-like member superposed on the fiber bundle, and a bonding part that bonds the fiber bundle and the cleaning side sheet-like member,  
 30  
 the fiber bundle is formed by arranging a plurality of fiber bundle constituent fibers having prescribed orientation,  
 35  
 the cleaning side sheet-like member has a first surface facing the fiber bundle, a second surface on the side opposite to the first surface, a cut element and a strip element defined by the cut element,  
 40  
 the cut element comprises a plurality of cuts, the strip element is formed between adjacent ones of the cuts and has a first strip and a second strip,  
 45  
 the fiber bundle constituent fibers are configured to be bent along the bonding part so as to be raised up in a direction away from the holding region,  
 50  
 each of the first strip and the second strip has a first engagement part formed on the first surface and a second engagement part formed on the second surface and is configured to be bent along the bonding part so as to be raised up in a direction away from the holding region,  
 55  
 when the first strip and the second strip are raised, the first engagement part can be engaged with the fiber bundle constituent fibers, and the second engagement part of the first strip and the second engagement part of the second strip can be engaged with each other.

FIG. 1

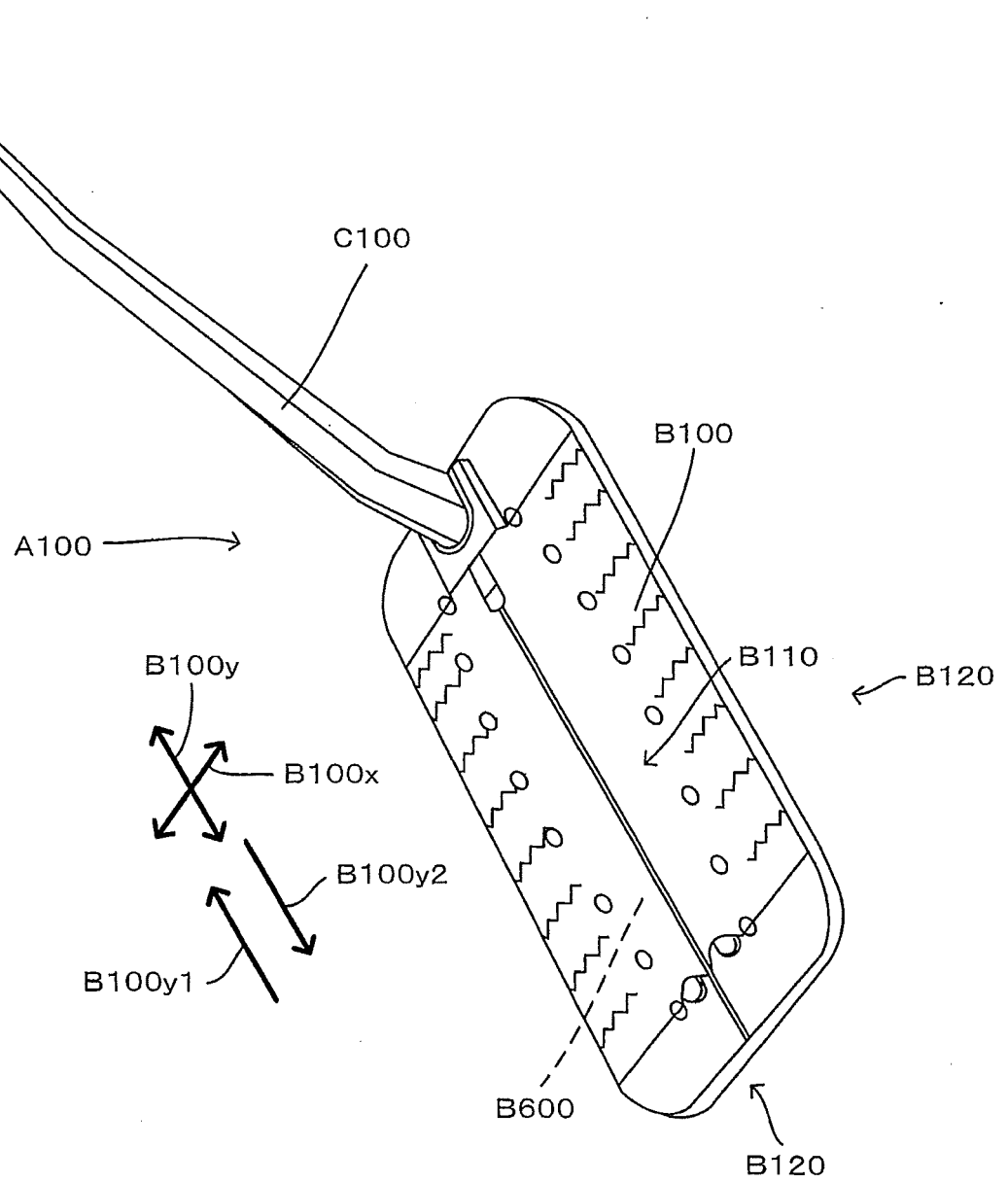


FIG. 2

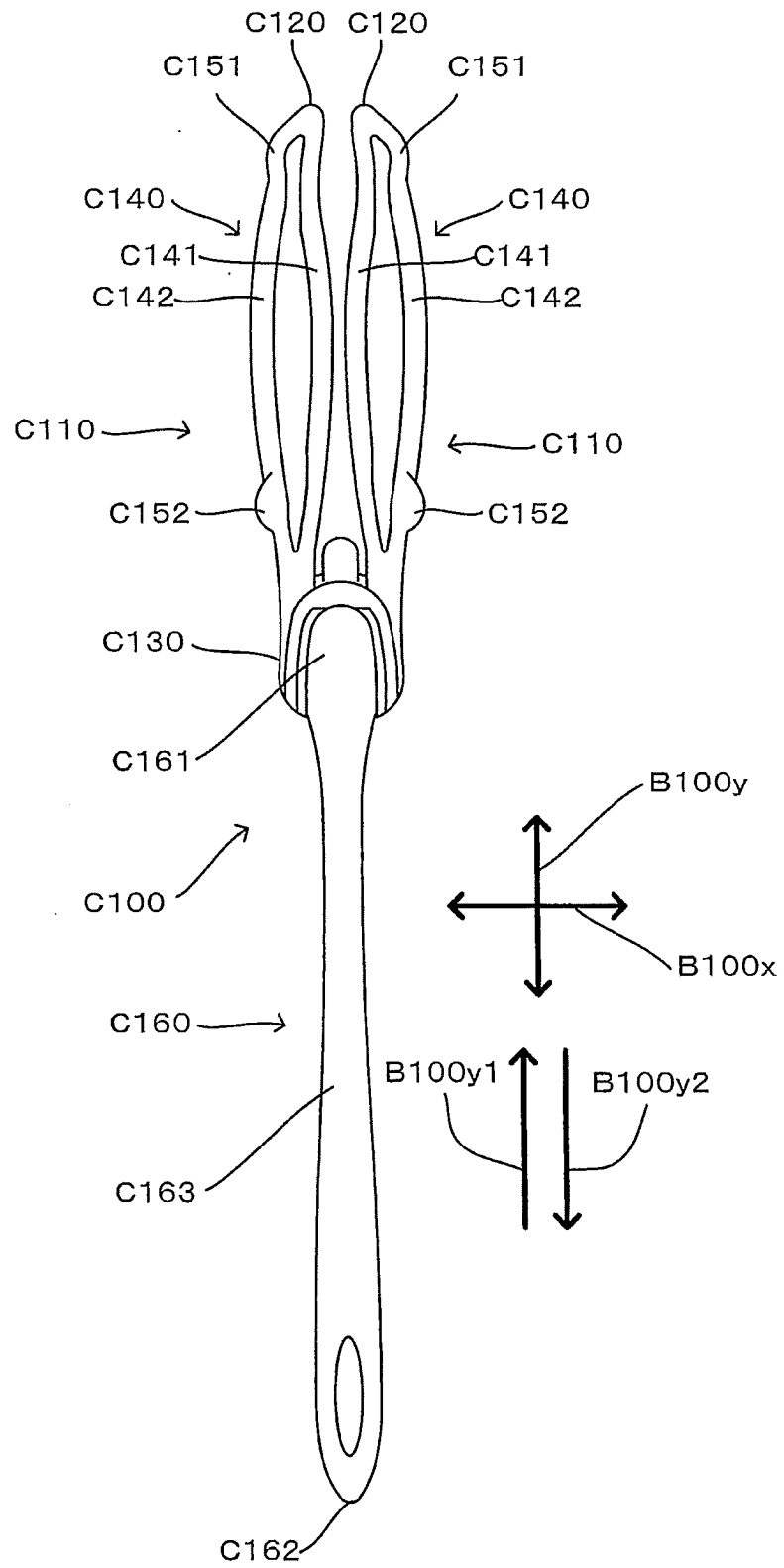


FIG. 3

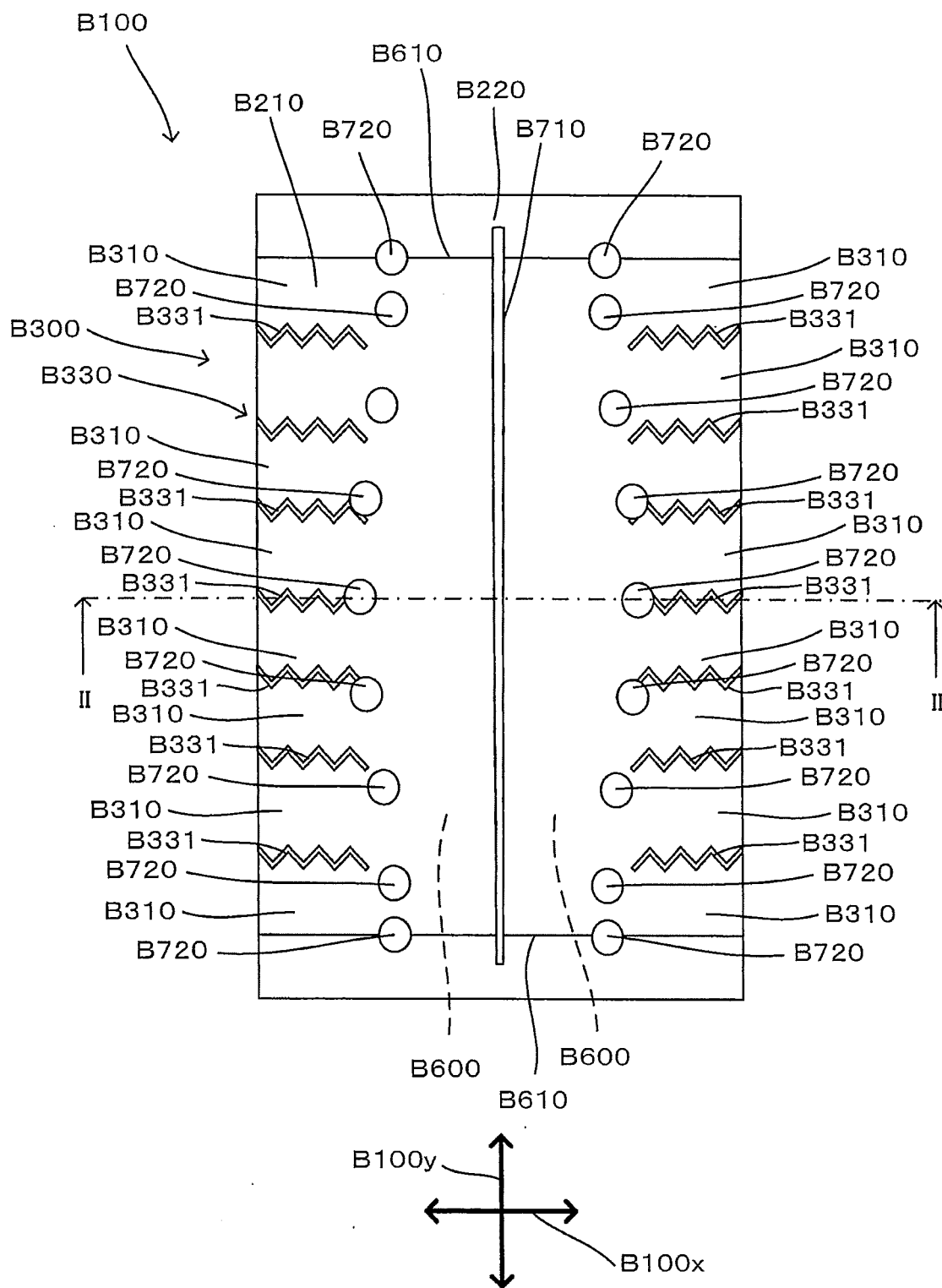


FIG. 4

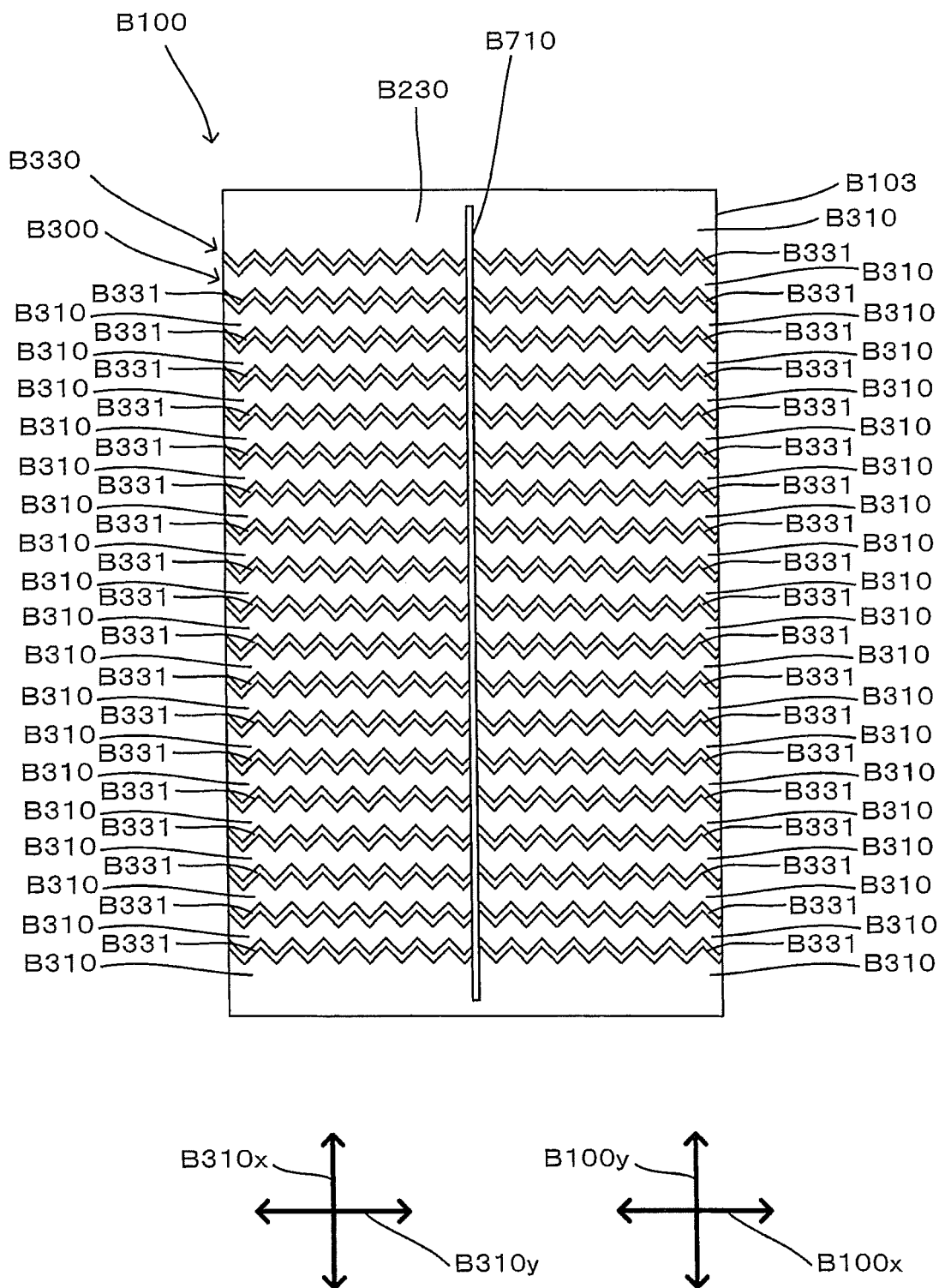


FIG. 5

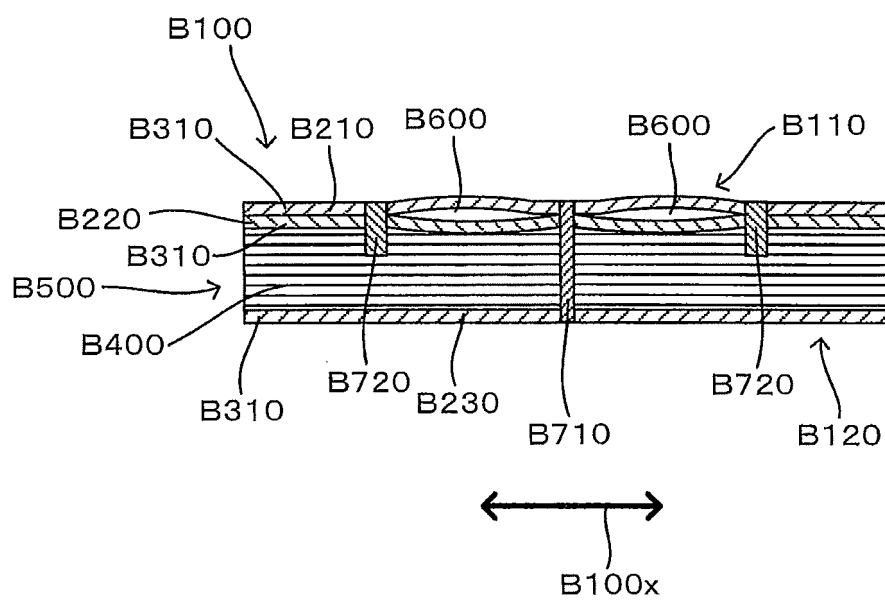


FIG. 6

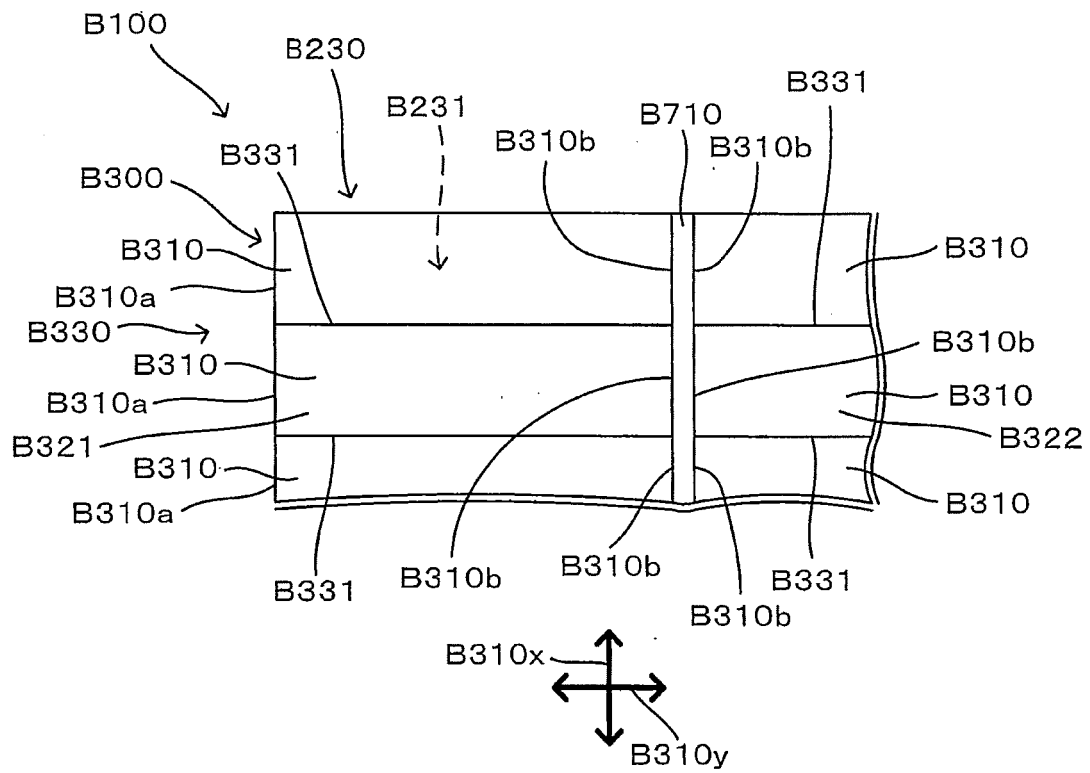


FIG. 7

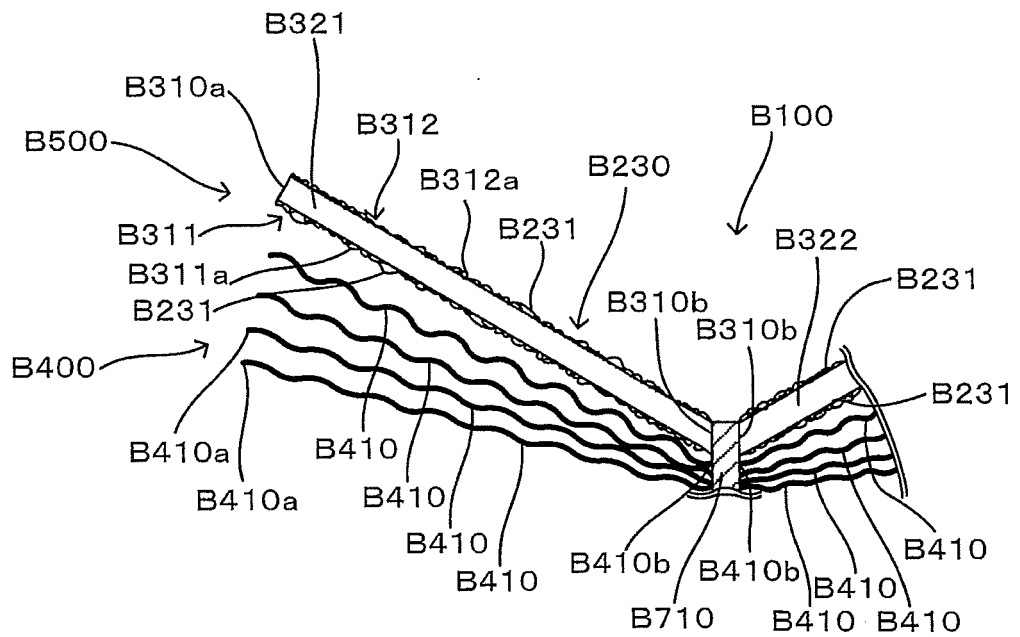


FIG. 8

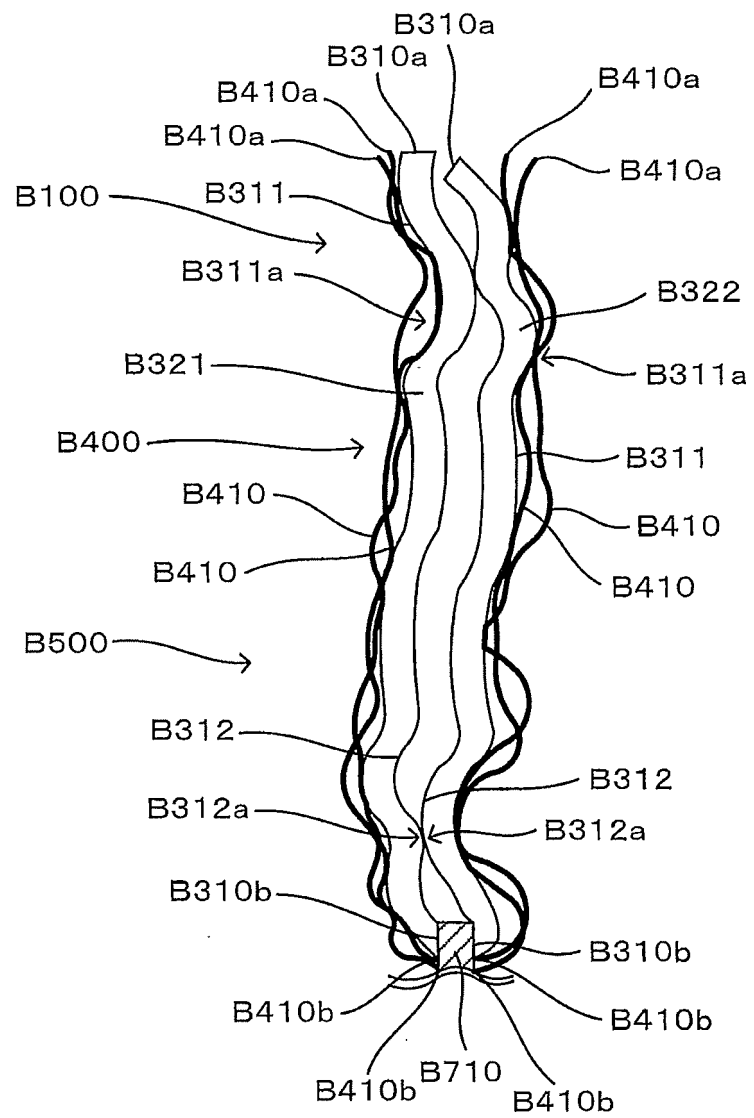
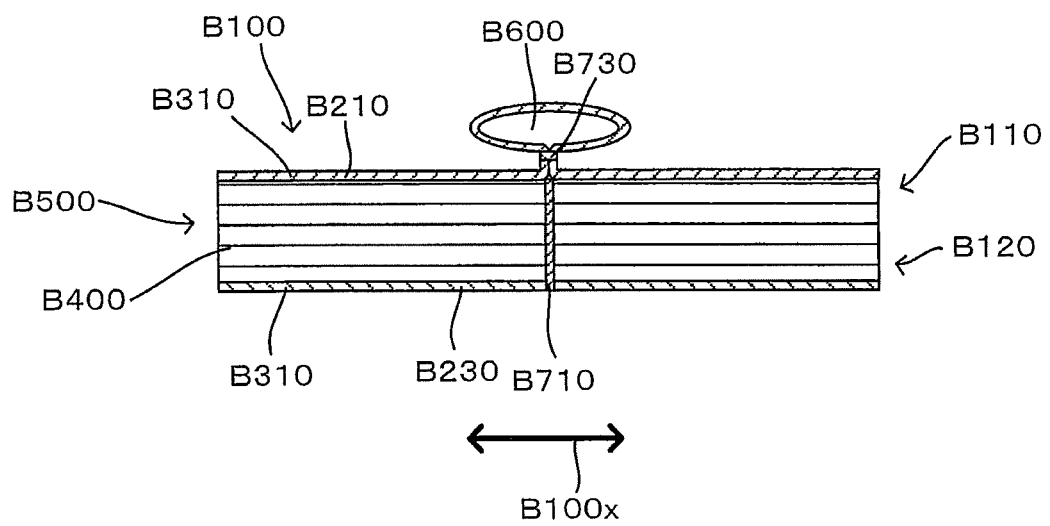


FIG. 9



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/059507

## A. CLASSIFICATION OF SUBJECT MATTER

A47L13/00(2006.01)i, A47L7/00(2006.01)i

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)

A47L13/00, A47L7/00

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2015

Kokai Jitsuyo Shinan Koho 1971-2015 Toroku Jitsuyo Shinan Koho 1994-2015

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. |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| A         | JP 2007-136156 A (Kao Corp.),<br>07 June 2007 (07.06.2007),<br>paragraphs [0026], [0046], [0084]; fig. 1 to 2,<br>6<br>& US 2009/0255078 A1 & WO 2007/046252 A1<br>& EP 1938738 A1 & KR 10-2008-0055894 A<br>& CA 2625482 A & AU 2006305395 A<br>& ES 2388746 T & TW 00I388306 B | 1-18                  |
| A         | WO 2010/114070 A1 (Uni-Charm Corp.),<br>07 October 2010 (07.10.2010),<br>paragraphs [0066] to [0067]; fig. 8 to 9<br>& JP 5657525 B                                                                                                                                              | 1-18                  |

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

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"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

"&amp;" document member of the same patent family

Date of the actual completion of the international search  
12 June 2015 (12.06.15)Date of mailing of the international search report  
23 June 2015 (23.06.15)Name and mailing address of the ISA/  
Japan Patent Office  
3-4-3, Kasumigaseki, Chiyoda-ku,  
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/059507

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                                                                                          | Relevant to claim No. |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| A         | US 2008/0148508 A1 (Kikue YAMADA),<br>26 June 2008 (26.06.2008),<br>fig. 1, 2<br>& US 2008/0148508 A1 & WO 2006/070502 A1<br>& EP 1832217 A1 & DE 602005025249 D<br>& CA 2561362 A & TW 265016 B<br>& CN 1921793 A & BR PI0507221 A<br>& AU 2005320857 A & MX PA06009742 A<br>& HK 1101338 A & ES 2357541 T | 1-18                  |

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

**REFERENCES CITED IN THE DESCRIPTION**

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- JP 2014150963 A [0002] [0004]