METHOD OF PRODUCING CLEANING MEMBER

Applicant: UNICHARM CORPORATION, Shikokuchuo-shi (JP)
Inventors: Takayuki MATSUMOTO, Kanonji-shi (JP); Shigetomo TAKAHASHI, Kanonji-shi (JP); Yuji YAMASHITA, Kanonji-shi (JP); Hiroaki GOTO, Kanonji-shi (JP)
Assignee: UNICHARM CORPORATION, Shikokuchuo-shi (JP)
Appl. No.: 13/749,725
Filed: Jan. 25, 2013

Foreign Application Priority Data
Dec. 29, 2012 (JP) ................................. 2012-289184

Publication Classification
Int. Cl. B08B 1/00 (2006.01)
U.S. Cl. CPC ...................................... B08B 1/006 (2013.01)
USPC .............................................. 493/374

ABSTRACT
To provide a novel method of production and system of production which are suitable for producing a cleaning member excellent in cleaning performance and further which enable efficient production. The present invention is a method of producing a cleaning member which is obtained from a multilayer web which contains at least a fiber bundle and a belt-shaped nonwoven fabric, the method including at least a step of conveying the fiber bundle and a step of conveying the belt-shaped nonwoven fabric, the tension of the fiber bundle in the step of conveying the fiber bundle being lower than the tension of the belt-shaped nonwoven fabric in a step of conveying the belt-shaped nonwoven fabric.
FIG. 5

High Tension

Conveying Direction

Low Tension

Conveying Direction
METHOD OF PRODUCING CLEANING MEMBER

TECHNICAL FIELD

[0001] The present invention relates to a method of producing a cleaning member and a system of producing a cleaning member.

BACKGROUND ART

[0002] Various types of cleaning members which can trap dirt, dust, refuse, etc. have been known in the past. Methods of producing these various types of cleaning members have been studied actively from various viewpoints in recent years.

[0003] For example, in PTL 1, there is proposed a method of production of a cleaning-use article provided with a step of overlaying a belt-shaped inside fiber layer which is comprised of a continuous fiber bundle with a belt-shaped sheet member and partially joining the two to form a first web, similarly forming a second web, overlaying these first and second webs and partially fastening them, then overlaying and fastening belt-shaped outside fiber layers which are comprised of continuous fiber bundles at the inside fiber layer sides at the first and second webs, a step of cutting the laminate which is obtained in the above step into predetermined lengths, and a step of treating the fiber layer parts at the cut laminate with compressed air to make the fiber bundles open, in the method of production of a cleaning-use article, the belt-shaped inside fiber layers and outside fiber layers being respectively comprised of fiber bundles which are comprised of crimped fibers which are bent in zigzag shapes, a difference of heights between peaks and valleys which are alternately present in the crimped fibers being 0.1 to 0.7 mm, and, in the step of opening the fiber bundles, raising the fiber bundles at the cut laminate so that the entire circumference of the cleaning-use article is covered by the front ends of bristles comprised of fibers of the fiber bundles.

[0004] Further, for example, in PTL 2, there is proposed a method of production of a cleaning-use article comprising producing a first web which has a first fiber layer which is comprised of a continuous fiber bundle and has a first belt shaped member, the two side parts of the first belt shaped member in the long direction being folded and fastened, the first fiber layer being overlaid and fastened to an outer surface side of the first belt shaped member, and a second web which has a second fiber layer which is comprised of a continuous fiber bundle and has a second belt shaped member, the two side parts of second first belt shaped member in the long direction being folded and fastened, the second fiber layer being overlaid and fastened to the outer surface side of the second belt shaped member, overlaying and joining the produced first web and second web, then respectively overlaying and fastening a third fiber layer and fourth fiber layer comprised of continuous fiber bundles on the first fiber layer and the second fiber layer and cutting the formed laminate to obtain individual cleaning-use articles, the method of production of a cleaning-use article having a step of forming at each of the first belt shaped member and the second belt shaped member a center part which is sandwiched between a pair of break guide lines and outward parts which are connected to the center part through the break guide lines by intermittently forming the first belt shaped member and the second belt shaped member with the break guide lines across the entire regions in the width directions of the first belt shaped member and the second belt shaped member, a step of joining the first belt shaped member and the second belt shaped member after formation of the break guide lines to the first fiber layer and the second fiber layer by center continuous seal lines across the entire regions in the width directions of the first fiber layer and the second fiber layer so as to produce the first web and the second web, a step of overlaying the first web and the second web and joining them by side discontinuous seal lines across the width directions of the first fiber layer and the second fiber layer, a step of further overlaying and fastening a third fiber layer and a fourth fiber layer on the first fiber layer of the first web and the second fiber layer on the second web to form the laminate, a step of cutting off the outward parts positioned at the two sides of the center parts while leaving the center parts sandwiched by the pairs of break guide lines after cutting the laminate, and a step of opening the cut first to fourth fiber layers to form random piles in the three dimensions after cutting the laminate.

[0005] Furthermore, for example, in PTL 3, there is provided a method of production of a cleaning-use article as set forth in claim 1, the method of production of a cleaning-use article comprising laminating four webs of long shaped fiber layers comprised of fiber bundles oriented in a single direction, two webs of long shaped scraping sheets, and two webs of long shaped substrate sheets in the order of a fiber layer web, a scraping sheet web, a fiber layer web, two substrate sheet webs, a fiber layer web, a scraping sheet web, and a fiber layer web, bonding the webs at predetermined intervals across the width direction to prepare a cleaning-use article web, and, next, cutting the cleaning-use article web between the bonded parts of the fiber layer webs, the substrate sheet webs, and the scraping sheet webs across the width direction to obtain a plurality of the cleaning-use articles.

CITATIONS LIST

Patent Literature

[0006] [PTL 1] Japanese Patent No. 4878988

SUMMARY OF INVENTION

Technical Problem

[0009] However, a novel method of production and a novel system of production for producing a cleaning member which can efficiently trap dirt, dust, refuse, etc. are desired at the present time. The present invention was discovered based on such a situation as a result of in-depth studies by the inventors.

[0010] That is, the present invention has as its object the provision of a novel method of production and system of production which are suitable for production of a cleaning member which is excellent in cleaning performance and further enable efficient production.

Solution to Problem

[0011] To achieve the above object, the present invention provides a method of producing a cleaning member which is obtained from a multilayer web which contains at least a fiber bundle and a belt-shaped nonwoven fabric, the method of producing a cleaning member include a step of conveying the fiber bundle, a step of conveying the belt-shaped nonwoven fabric, a step of overlaying the conveyed fiber bundle and the
conveyed belt-shaped nonwoven fabric to form a multilayer web, a step of fastening the multilayer web, the tension of the fiber bundle in the step of conveying the fiber bundle being lower than the tension of the belt-shaped nonwoven fabric in the step of conveying the belt-shaped nonwoven fabric and a strength of fastening of the multilayer web being adjusted by the tension of the fiber bundle and the tension of the belt-shaped nonwoven fabric.

Advantageous Effects of Invention

[0012] According to the present invention, a novel method of production and system of production which are suitable for production of a cleaning member which is excellent in cleaning performance and which further enables efficient production are provided.

BRIEF DESCRIPTION OF DRAWINGS

[0013] FIG. 1 is a perspective view of a cleaning member which is produced by an embodiment of the method of production and/or system of production of the present invention and a handle which is fastened to the cleaning member.
[0014] FIG. 2 is a cross-sectional view along the line X-X of FIG. 1.
[0015] FIG. 3 is a plan view of the cleaning member which is shown in FIG. 1.
[0016] FIG. 4 is a schematic view for explaining a method of production and/or system of production of a cleaning member which is shown in FIG. 1.
[0017] FIG. 5 is a view which shows one embodiment of a method of production and/or system of production of the present invention.

DESCRIPTION OF EMBODIMENTS

[0018] [Method of Producing Cleaning Member]
[0019] Below, a method of producing a cleaning member according to the present invention will be explained in detail.
[0020] A method of producing a cleaning member according to the present invention is a method of producing a cleaning member which is obtained from a multilayer web which contains at least a fiber bundle and a belt-shaped nonwoven fabric, the method of producing a cleaning member including a step of conveying the fiber bundle, a step of conveying the belt-shaped nonwoven fabric, a step of overlaying the conveyed fiber bundle and the conveyed belt-shaped nonwoven fabric to form a multilayer web, and a step of fastening the multilayer web, the tension of the fiber bundle in the step of conveying the fiber bundle being lower than the tension of the belt-shaped nonwoven fabric in the step of conveying the belt-shaped nonwoven fabric, and a strength of fastening of the multilayer web being adjusted by the tension of the fiber bundle and the tension of the belt-shaped nonwoven fabric (Aspect 1).

[0021] The method of producing a cleaning member according to the present invention is a novel method of production which is suitable for production of a cleaning member which is excellent in cleaning performance and further enables efficient production. The method of producing a cleaning member according to the present invention makes the tension of the fiber bundle in the step of conveying the fiber bundle lower than the tension of the belt-shaped nonwoven fabric at the step of conveying the belt-shaped nonwoven fabric due to which the piles of the fiber bundle which form the cleaning member will never become shorter than the width of the belt-shaped nonwoven fabric, so the fiber bundle will more easily contact dust, dirt, etc. and the cleaning performance will be improved and, further, the fiber bundle and belt-shaped nonwoven fabric, in particular the fiber bundle, will become harder to cut at the time of conveyance, in particular will become harder to cut by being melted at the time of melt bonding or otherwise fastening the later explained fiber bundle and belt-shaped nonwoven fabric, so becomes superior in high speed productivity. Further, by the tension of the fiber bundle and the tension of the belt-shaped nonwoven fabric being adjusted, it is possible to control the strength at the time of fastening the multilayer web and prevent it from dropping.

[0022] In the Aspect 1, in the step of conveying the fiber bundle, the fiber bundle is preferably conveyed substantially straight (Aspect 2). According to the Aspect 2, it is possible to obtain excellent high speed productivity of a cleaning member and to efficiently produce a cleaning member. Here, the "fiber bundle being conveyed substantially straight" means the fiber bundle being conveyed without snaking.

[0023] In the Aspect 1 or 2, in the step of conveying the belt-shaped nonwoven fabric, the belt-shaped nonwoven fabric is preferably conveyed substantially straight (Aspect 3). According to the Aspect 3, it is possible to obtain excellent high speed productivity of a cleaning member and to efficiently produce a cleaning member. Here, the "belt-shaped nonwoven fabric being conveyed substantially straight" means the extent of the belt-shaped nonwoven fabric being conveyed without snaking.

[0024] In any of the aspects of the Aspects 1 to 3, in the step of conveying the fiber bundle, the fiber bundle is preferably conveyed with the length of the fiber bundle in the width direction substantially constant (Aspect 4). The "length of the fiber bundle in the width direction substantially constant" means the length of the fiber bundle in the width direction does not become shorter than the width due to tension of the fiber bundle. According to the Aspect 4, it is possible to obtain excellent high speed productivity of a cleaning member and to efficiently produce a cleaning member.

[0025] In any of the aspects of the Aspects 1 to 4, in the step of conveying the belt-shaped nonwoven fabric, the belt-shaped nonwoven fabric is preferably conveyed with the length of the belt-shaped nonwoven fabric in the width direction substantially constant (Aspect 5). The "length of belt-shaped nonwoven fabric in the width direction substantially constant" means the length of the fiber bundle in the width direction does not become shorter than the width due to tension of the fiber bundle. According to the Aspect 5, it is possible to obtain excellent high speed productivity of a cleaning member and to efficiently produce a cleaning member.

[0026] In the aspect of the Aspect 5, the step of fastening the multilayer web is preferably a step of melt bonding (Aspect 6). In another aspect, the step of fastening is a step of fastening by a hot melt adhesive.

[0027] In any of the aspects of the Aspects 1 to 6, the fiber bundle is preferably an opened fiber bundle (Aspect 7). To open the fiber bundle, the method of producing a cleaning member according to the present invention includes a step of opening the fiber bundle.

[0028] In any of the aspects of the Aspects 1 to 7, the method further includes a step of cutting the multilayer web in the width direction (Aspect 8).
In the method of producing a cleaning member according to the present invention, two or more of the Aspects 1 to 8 may be combined.

[0030] [System of Producing Cleaning Member]

[0031] Below, a system of producing a cleaning member according to the present invention will be explained in detail.

[0032] The system of producing a cleaning member according to the present invention is a system of producing a cleaning member which is obtained from a multilayer web including a fiber bundle and a belt-shaped nonwoven fabric, the system of producing a cleaning member being a system provided with at least a device which conveys the fiber bundle, a device which conveys the belt-shaped nonwoven fabric, a device which overlays the conveyed fiber bundle and the conveyed belt-shaped nonwoven fabric to form the multilayer web, and device which fastens the multilayer web, a tension of the fiber bundle at the device which conveys the fiber bundle is lower than a tension of the belt-shaped nonwoven fabric at the device which conveys the belt-shaped nonwoven fabric, and a strength of fastening of the multilayer web is adjusted by the tension of the fiber bundle and the tension of the belt-shaped nonwoven fabric (Aspect 9).

[0033] The system of producing a cleaning member according to the present invention is a novel system of production which is suitable for producing a cleaning member which is excellent in cleaning performance and which further enables efficient production. Due to the fact that a tension of the fiber bundle at the device which conveys the fiber bundle is lower than a tension of the belt-shaped nonwoven fabric at the device which conveys the belt-shaped nonwoven fabric, the piles of the fiber bundle which form the cleaning member will never become shorter than the width of the belt-shaped nonwoven fabric, so the fiber bundle can more easily contact dust, dirt, etc. and the cleaning performance is improved and, further, the fiber bundle and belt-shaped nonwoven fabric, in particular the fiber bundle, become hard to cut at the time of conveyance, in particular, become hard to be cut by melting at the time of melt bonding or other fastening of the later explained fiber bundle and belt-shaped nonwoven fabric, so the high speed productivity becomes excellent. Further, by adjusting the tension of the fiber bundle and the tension of the belt-shaped nonwoven fabric, the strength of sealing of the multilayer web can be controlled and kept from dropping.

[0034] In the Aspect 9, the system is preferably further provided with a device which cuts the multilayer web in the width direction (Aspect 10).

[0035] The system of producing a cleaning member according to the present invention can provide a device for opening a fiber bundle so as to open the fiber bundle.

[0036] In the system of producing a cleaning member according to the present invention, the Aspects 9 and 10 can be combined.

[0037] Below, based on FIG. 1 to FIG. 5, an embodiment of a method and system of producing a cleaning member according to the present invention will be explained in further detail. Note that, the method and system of producing a cleaning member according to the present invention are not limited to the embodiments of the present invention which are shown in FIG. 1 to FIG. 5 so long as in the range not departing from the object and gist of the present invention.

[0038] First, based on FIG. 1 to FIG. 3, the cleaning member 1 will be explained.

[0039] FIG. 1 is a perspective view of a cleaning member 1 and a handle 15 which is fastened to the cleaning member 1, FIG. 2 is a cross-sectional view along the line X-X of FIG. 1, and FIG. 3 is a plan view of the cleaning member 1 which is shown in FIG. 1. Note that, in the following explanation, “top” in FIG. 2 means the top side, while “bottom” means the bottom side in some cases, but the “top” and “bottom” in FIG. 2 are merely used for convenience of explanation. The up-down directions of the cleaning member 1 are not limited.

[0040] As shown in FIG. 1 to FIG. 3, the cleaning member 1 is provided with a brush sheet 2, a substrate sheet 12 which is laid on a top side of the brush sheet 2, and a holding sheet 13 which is laid on a top side of the substrate sheet 12.

[0041] As shown in FIG. 1 to FIG. 3, the cleaning member 1 is formed with receiving parts 14 for insertion of insert parts 16 between the substrate sheet 12 and the holding sheet 13. As shown in FIG. 1 to FIG. 3, the cleaning member 1 is formed with two receiving parts 14 and enables insertion of two branched insert parts 16. There are two receiving parts 14 in the present embodiment, but the number of receiving parts 14 can be suitably changed in accordance with the number of branched insert parts 16. As another embodiment, an embodiment in which there are three or more receiving parts 14 may be mentioned.

[0042] As shown in FIG. 2, the brush sheet 2 is provided with a four-layer structure fibrous member which is comprised of a first fibrous member 3, a second fibrous member 4 which is overlaid at a bottom side of the first fibrous member 3, a third fibrous member 5 which is overlaid at a bottom side of the second fibrous member 4, and a fourth fibrous member 6 which is overlaid at a bottom side of the third fibrous member 5 and a sheet with slits 7 which is overlaid at a bottom side of this four-layer structure fibrous member (bottom side of fourth fibrous member 6). The fibrous member of the brush sheet 2 in the present embodiment is a four-layer structure, but the layer structure of the fibrous member may be suitably changed. As other embodiments, embodiments in which the fibrous member has a layer structure of a single-layer structure, two-layer structure, or three-layer structure may be mentioned. Further, as other embodiments, embodiments in which the fibrous member has a layer structure of a five-layer or more structure may be mentioned. Further, the brush sheet 2 in the present embodiment is provided with a sheet with slits 7, but the presence or absence of the sheet with slits 7 may be suitably selected. As another embodiment, an embodiment which omits the sheet with slits 7 may be mentioned.

[0043] The first to fourth fibrous members 3 to 6 are oilier fiber bundles. The oil is a dust catching oil which has the action of promoting adsorption of dust etc. (for example, an oil mainly comprised of liquid paraffin).

[0044] The fiber bundle is, for example, a tow, preferably opened tow. Note that, a “tow” is described in JIS L 0204-3: 1998, section 3.1.24, and means a bundle of an extremely large number of filaments aligned together.

[0045] The fiber bundle may also be a bundle of slit fibers (fibers obtained by cutting and stretching a film in an elongated manner), split fibers (fibers obtained by dividing an elongated film into a net structure), etc.

[0046] As the fiber bundle, for example, a fiber bundle comprised of thermoplastic fibers, a fiber bundle including thermoplastic fibers, etc. may be mentioned. As the material of the fibers forming the fiber bundle, for example, polyethylene, polypropylene, polyethylene terephthalate, nylon, rayon, etc. may be mentioned. As the type of the fibers forming the fiber bundle, for example, monofilaments, composite fibers (for example, core-sheath type composite fibers or side-
by-side type composite fibers), etc. may be mentioned. The composite fibers, from the viewpoint of the thermal bondability, are preferably core-sheath type composite fibers, more preferably core-sheath type composite fibers with a melting point of the core higher than the melting point of the sheath.

As preferable core-sheath type composite fibers, for example, core-sheath type composite fibers with a core comprised of polypropylene or polyethylene terephthalate and a sheath comprised of polyethylene may be mentioned, while as more preferable core-sheath type composite fibers, for example, core-sheath type composite fibers with a core comprised of a polyethylene terephthalate and a sheath comprised of polyethylene may be mentioned.

The denier of the fibers which forms the fiber bundle is preferably 1 to 50 denier, more preferably 2 to 10 denier. The fiber bundle may include a plurality of types of fibers which have the same denier or may include one or more types of fibers which have different deniers.

In the present embodiment, the fibers which form the fiber bundle are comprised of crimped fibers. By forming the fibers by crimped fibers, it is possible to increase the bulk of the fiber bundle and possible to make the crimped parts structures which easily take in dust, dirt, etc. As another embodiment, embodiments where the fibers which form the fiber bundle are comprised of non-crimped fibers may be mentioned.

The sheet with slits 7, as explained later, in the same way as the substrate sheet 12 and holding sheet 13, is formed from a nonwoven fabric which is comprised of thermoplastic fibers (hot bondable fibers) or a nonwoven fabric which includes thermoplastic fibers and is formed into a rectangular shape of substantially the same width and substantially the same length as the substrate sheet 12. The sheet with slits 7 is provided with sawtooth shaped slits (not shown) at predetermined intervals across the entire sheet with slits 7. Due to the slits, across the entire length of the two edge parts in the width direction of the sheet with slits 7, the two edges are formed with sawtooth shaped reed-shaped parts (not shown).

As shown in FIG. 1 to FIG. 3, at the top side of the first fibrous member 3 of the brush sheet 2, the substrate sheet 12 and the holding sheet 13 are overlaid in that order. Between the substrate sheet 12 and the holding sheet 13, receiving parts 14 are formed for insertion of insert parts 16 of the handle 15.

As shown in FIG. 3, the substrate sheet 12 and the holding sheet 13 have rectangular shapes. The two sheets 12 and 13 are set to the same dimensions in the width direction (left-right direction of FIG. 3), while the substrate sheet 12 is set longer in dimension in the length direction (up-down direction of FIG. 3). The holding sheet 13 is overlaid on the top side of the substrate sheet 12 so that two end parts of the substrate sheet 12 in the long direction stick out outward from the two ends of the holding sheet 13 in the long direction by predetermined lengths.

The substrate sheet 12 and holding sheet 13 are formed from nonwoven fabrics which are comprised of thermoplastic fibers (hot bondable fibers) or nonwoven fabrics which include thermoplastic fibers. As thermoplastic fibers, for example, polyethylene fibers, polypropylene fibers, polyethylene terephthalate fibers, polyethylene and polyethylene terephthalate composite fibers, polyethylene and polypropylene composite fibers, core-sheath type composite fibers comprised, for example, of a core comprised of polyethylene terephthalate and a sheath comprised of polyethylene, etc. may be mentioned. As types of nonwoven fabrics, for example, thermal bond nonwoven fabrics, spunbonded nonwoven fabrics, spunlace nonwoven fabrics, etc. may be mentioned.

As other embodiments, embodiments in which the substrate sheet and the holding sheet are formed from thermoplastic resin films, for example, polyethylene films and polypropylene films, may be mentioned, while as further embodiments, embodiments in which the substrate sheet and the holding sheet are formed from laminate sheets of nonwoven fabrics and resin films may be mentioned.

The substrate sheet 12 and the holding sheet 13 are integrally melt bonded by a later explained first melt bonded part forming device 158 together with all of the layers of the brush sheet 2 (first fibrous member 3, second fibrous member 4, third fibrous member 5, fourth fibrous member 6, and sheet with slits 7), whereby the cleaning member 1, as shown in FIG. 1 to FIG. 3, is formed with a first melt bonded part 8 extending in the long direction at the center part in the width direction. Furthermore, the substrate sheet 12 and the holding sheet 13 are integrally melt bonded at the two sides of the first melt bonded part 8 (left and right in FIG. 2) by a later explained second melt bonded part forming device 134 together with one layer of the brush sheet 2 (first fibrous member 3), whereby the cleaning member 1 is formed with two second melt bonded parts 11 in the long direction. The two second melt bonded parts 11 are respectively formed intermittently. By the first fibrous member 3 being melt bonded with the substrate sheet 12 and the holding sheet 13, the first fibrous member 3 tracks movement of these sheets 12 and 13, so in the state of use, the brush sheet 2 easily becomes broader and, in turn, the cleaning efficiency is improved.

The substrate sheet 12 and the holding sheet 13 are melt bonded at the first melt bonded part 8 with all layers of the brush sheet 2 (first fibrous member 3, second fibrous member 4, third fibrous member 5, fourth fibrous member 6, and sheet with slits 7) and is melt bonded with the first fibrous member 3 of the brush sheet 2 at the two second melt bonded parts 11. Due to this, between the substrate sheet 12 and the holding sheet 13, a pair of receiving parts 14 are formed comprised of bag-shaped spaces which are defined by the first melt bonded part 8 and the two second melt bonded parts 11, which extend in the long direction of the substrate sheet 12 and the holding sheet 13, and which are open at the two ends in the long directions. The receiving parts 14 can receive the insert parts 16 of the handle 15.

The substrate sheet 12 and the holding sheet 13 are melt bonded by a later explained second melt bonded part forming device 134 with the first fibrous member 3 of the brush sheet 2 at the center part of these. The cleaning member 1, as shown in FIG. 3, is formed with a pair of melt bonding lines 18 at a predetermined interval in the width direction of the substrate sheet 12 and the holding sheet 13. Between the pair of melt bonding lines 18, the first melt bonded part 8 is formed. The pair of melt bonding lines 18 are marks for management of the position of the first melt bonded part 8 at the stage of production. By managing whether the first melt bonded part 8 is arranged between the pair of melt bonding lines 18 by sensors etc., it is possible to separate good products and bad products.

As shown in FIG. 1 to FIG. 3, the two second melt bonded parts 11 are provided intermittently at several locations in the long directions of the substrate sheet 12 and the holding sheet 13. By engaging the arc shaped projections 16a of the insert parts 16 of the handle 16 with nonmelt bonded
parts of the two second melt bonded parts 11, the insert parts 16 of the handle 15 can be prevented from being pulled out from the receiving parts 14.

[0059] As shown in FIG. 1, the two edge parts of the substrate sheet 12 and the holding sheet 13 in the width direction (outside parts of two second melt bonded part 11) are provided with sawtooth shaped slits 20a at predetermined intervals along the long direction. Due to the slits 20a, the two edges are provided with sawtooth shaped reed-shaped parts 20. As another embodiment, an embodiment in which the substrate sheet 12 and the holding sheet 13 are not provided with sawtooth shaped slits 20a and therefore the reed-shaped parts 20 are not provided may be mentioned.

[0060] As shown in FIG. 1, the handle 15 has a pair of long plate shaped insert parts 16 which are arranged in parallel to each other, a pair of arc-shaped projections 16a which stick out from the outside surfaces of the two ends parts in the long directions of the insert parts 16, and a holder 17 which is provided integrally with one of the end parts of the insert parts 16 and is, for example, formed from a plastic etc.

[0061] By inserting the two insert parts 16 of the handle 15 inside the two receiving parts 14 of the cleaning member 1 and engaging the projections 16a with non-melt bonded parts 11 of the second two melt bonded parts 11, the cleaning member 1 is attached to the handle 15. Further, by holding the holder 17 of the handle 15, bringing the brush sheet 2 into contact with a location being cleaned, and making it move in the desired direction, the dust, dirt, etc. of the location being cleaned is trapped by the brush sheet 2 and the location being cleaned is cleaned.


[0063] Next, one embodiment of the method and system for producing the cleaning member 1 will be explained based on FIG. 4.

[0064] FIG. 4 is a schematic view for explaining the method and system for producing the cleaning member 1. In the present embodiment, the system 100 which is shown in FIG. 4 is used to work the method for producing the cleaning member 1 and produce the cleaning member 1.

[0065] In the present embodiment, the method of production of the cleaning member 1 includes the following Step 1 and Step 2.

[0066] [Step 1] Step of opening fiber bundles to step of conveying them

[0067] [Step 2] Step of using fiber bundles to produce multilayer web and cutting out cleaning member 1 from multilayer web

[0068] [Step 1]

[0069] Below, Step 1 will be explained.

[0070] In the present embodiment, Step 1 includes the following Step 1a and Step 1b.

[0071] [Step 1a] Step of opening first fiber bundle F1 to fourth fiber bundle F4

[0072] [Step 1b] Step of conveying first fiber bundle F1 to fourth fiber bundle F4

[0073] In the present embodiment, Step 1 includes Step 1a, but the presence or absence of Step 1a may be suitably selected in accordance with the type of the fiber bundles used. As another embodiment, an embodiment in which Step 1a is omitted may be mentioned. For example, when the fiber bundles are comprised of noncrimped fibers, Step 1a may be omitted.

[0074] [Step 1a]

[0075] Below, Step 1a will be explained with reference to the example of the step of opening the first fiber bundle F1, but the steps of opening the other fiber bundles are similarly performed.

[0076] The first fiber bundle F1 which is comprised of crimped fibers is continuously pulled out from a storage container (not shown) and sent to first nip rolls 102a and 102b which rotate by a certain peripheral velocity V1. After passing the first nip rolls 102a and 102b, the first fiber bundle F1 passes through a plurality of tension rolls 104 and is sent to second nip rolls 106a and 106b which rotate by a peripheral velocity V2.

[0077] The peripheral velocity V2 of the second nip rolls 106a and 106b is larger than the peripheral velocity V1 of the first nip rolls 102a and 102b. Due to this difference in peripheral velocities, between the first nip rolls 102a and 102b and the second nip rolls 106a and 106b, the first fiber bundle F1 is given tension. As a result, the first fiber bundle F1 is opened.

[0078] The tension rolls 104, for example, are formed from solid steel and are adjusted in mass so that a considerable degree of force is required to rotate them. Therefore, while the first fiber bundle F1 is passing the tension rolls 104 and advancing from the first nip rolls 102a and 102b toward the second nip rolls 106a and 106b, the speed of movement of the first fiber bundle F1 does not rapidly increase.

[0079] The tension rolls 104 are arranged to be able to gradually open the first fiber bundle F1 by the distance between the first nip rolls 102a and 102b and the second nip rolls 106a and 106b becoming longer.

[0080] The first fiber bundle F1 which passes through the second nip rolls 106a and 106b passes through an air feeder 108 and is sent to third nip rolls 112a and 112b which rotate
by a peripheral velocity $V_3$. The peripheral velocity $V_3$ of the third nip rolls 112a and 112b is slower than the peripheral velocity $V_2$ of the second nip rolls 106a and 106b. Due to this difference in peripheral velocities, between the second nip rolls 106a and 106b and the third nip rolls 112a and 112b, the tension of the first fiber bundle F1 is eased. As a result, the first fiber bundle F1 is further opened and the width of the first fiber bundle F1 is expanded.

The first fiber bundle F1 which is sent to the second nip rolls 106a and 106b to the third nip rolls 112a and 112b is blown with air from the air feeder 108. As a result, the first fiber bundle F1 is further opened.

In the present embodiment, to open the first fiber bundle F1, the operation of imparting and easing tension and the operation of blowing air are used, but the opening method may be suitably changed. As another embodiment, an embodiment in which either the operation of imparting and easing tension and the operation of blowing air is used may be mentioned. Further, as another embodiment, an embodiment in which the operation of imparting and easing tension and the operation of blowing air plus use of another opening method may be mentioned. Further, in the present embodiment, for the operation of imparting and easing tension, first to third nip rolls are used, but the number of nip rolls can be suitably changed. As another embodiment, for the operation of imparting and easing tension, an embodiment in which other nip rolls are used in addition to the first to third nip rolls may be mentioned.

The oil tank 114 contains an oil. In the present embodiment, the oil which is contained in the oil tank 114 is a dust catching oil which has the action of promoting adsorption of dust, dirt, etc. (for example, oil mainly comprised of liquid paraffin).

Below, in Step 1b, the conveyance step for the first fiber bundle F1 will be explained as an example, but the conveyance step for other fiber bundles are similarly performed.

If passing the third nip rolls 112a and 112b, the first fiber bundle F1 does not pass the nip rolls, tension rolls, etc. until the merging part 132, so the first fiber bundle F1 is not given a stronger tension from the first nip rolls 102a and 102b than the tension between the third nip rolls 112a and 112b.

Further, the first fiber bundle F1 advances to the merging part 132. Similarly, after Step 1b, the second to fourth fiber bundles F2 to F4 respectively advance to the merging parts 136, 138, and 140.

Below, Step 2 will be explained.

In the present embodiment, Step 2 includes the following Step 2a to Step 2c.

Step 2a: Step of laying fiber bundle after Step 1b over other member (in the present embodiment, belt-shaped nonwoven fabric) to form multilayer web

Step 2b: Step of fastening fiber contained in multilayer web with other members

Step 2c: Step of cutting out individual cleaning members 1 from multilayer web

Below, Step 2a will be explained.

In the present embodiment, the other member which is overlaid with fiber bundles after Step 1b is a belt-shaped nonwoven fabric 121, 123, or 151. As another embodiment, an embodiment in which one or two of these belt-shaped nonwoven fabrics is overlaid with fiber bundles after passing through Step 1b may be mentioned. Further, as another embodiment, an embodiment in which, in addition to these belt-shaped nonwoven fabrics, another belt-shaped nonwoven fabric is overlaid with a fiber bundle after Step 1b may be mentioned. Whatever the embodiment, the order of lamination is not particularly limited, but the belt-shaped nonwoven fabric is preferably positioned at the outermost layer by the lamination.

The belt-shaped nonwoven fabrics 121 and 123 respectively correspond to the substrate sheet 12 and holding sheet 13 of the cleaning member 1. The belt-shaped nonwoven fabric 121 is continuously unrolled from a nonwoven fabric roll 120 and is intermittently conveyed by being passed through dancer rolls 124 which include a plurality of rolls arranged in two top/bottom stages and where the rolls which are positioned at the bottom stage rock up and down. Similarly, the belt-shaped nonwoven fabric 123 is continuously unrolled from a nonwoven fabric roll 122 and is intermittently conveyed by being passed through dancer rolls 126 which include a plurality of rolls arranged in two top/bottom stages and where the rolls which are positioned at the bottom stage rock up and down. Note that, “intermittently conveyed” means the belt-shaped nonwoven fabrics 121 and 123 are repeatedly advanced by exactly certain distances (for example, substantially the width direction length of the cleaning member 1) in the machine direction then stopped from being conveyed for a certain time. By the belt-shaped nonwoven fabrics 121 and 123 being intermittently conveyed in this way, it is possible to secure the time for melt bonding the component elements of the later explained multilayer web.

The belt-shaped nonwoven fabrics 121 and 123 maintain a certain tension while forming a multilayer web S1 at a merging part 128. The multilayer web S1 passes through gather cutters 130 at the surfaces of which sawtooth shaped blades (not shown) at intermittently formed at their surfaces in the peripheral direction. Due to this, slits are formed which correspond to the slits 20a of the substrate sheet 12 and holding sheet 13 (see FIG. 1). Further, the multilayer web S1 advances to a merging part 132 while maintaining a certain tension.

The multilayer web S1 merges at the merging part 132 with the first fiber bundle F1 which has passed through Step 1 and which has not been given tension. The first fiber bundle F1 is overlaid on the multilayer web S1 whereby the multilayer web S2 is formed. The first fiber bundle F1 is configured to slack a certain extent between the third nip rolls 112a and 112b and merging part 132. Due to this, the dancer rolls act in the same way as if provided between them. That is, the first fiber bundle F1 becomes a state not given tension between the third nip rolls 112a and 112b and the merging part 132.

The multilayer web S2 successively merges at the merging parts 136, 138, and 140 with the second fiber bundle F2 to fourth fiber bundles F4 passing through Step 1 whereby the second fiber bundle F2 to fourth fiber bundle F4 are successively overlaid on the multilayer web S2 and the multilayer web S3 is formed.

The belt-shaped nonwoven fabric 151 corresponds to a sheet with slits 7 of the cleaning member 1. The belt-shaped nonwoven fabric 151 is continuously unrolled from a nonwoven fabric roll 150 and passed through dancer rolls 152 to thereby be intermittently conveyed and further, passes through gather rolls 154. The gather rolls 154 have continu-
ous sawtooth shaped blades (not shown) at their surfaces in their peripheral directions. Due to this, sawtooth shaped slits (not shown) are formed in the belt-shaped nonwoven fabric 151 which passes through the gather rolls 154.

[0102] The belt-shaped nonwoven fabric 151 merges at the merging part 156 with the multilayer web S3 whereby the belt-shaped nonwoven fabric 151 is laid over the multilayer web S3 and the multilayer web S4 is formed.

[0103] [Step 2b/]
[0104] Below, Step 2b will be explained.
[0105] The multilayer web S2 passes through the second melt bonded part forming device 134 before the second fiber bundle F2 to fourth fiber bundle F4 merge. The second melt bonded part forming device 134 melt bonds the belt-shaped nonwoven fabric 121, 123 and first fiber bundle F1 which are contained in the multilayer web S2 and forms two second melt bonded parts 11 (see FIG. 3). Due to this, the multilayer web S2 is melt bonded across its thickness direction. In the present embodiment, as the second melt bonded part forming device 134, a heat seal device is used, but another sealing device (for example, ultrasonic wave sealing device etc.) may also be used.

[0106] The multilayer web S4 passes through the first melt bonded part forming device 158. The first melt bonded part forming device 158 melt bonds the multilayer web S4 as a whole and forms a first melt bonded part 8 at the multilayer web S4 (see FIG. 3 etc.). Due to this, the multilayer web S4 is melt bonded over the thickness direction. In the present embodiment, as the first melt bonded part forming device 154, a heat seal device is used, but the melt bonded part forming device may be suitably changed. As another embodiment, an embodiment in which an ultrasonic wave sealing device is used may be mentioned.

[0107] [Step 2c/]
[0108] Below, Step 2c will be explained.
[0109] The multilayer web S4 which passes through the first melt bonded part forming device 158 is cut by the cutting device 160 whereby individual cleaning members 1 are cut out.

[0110] The cleaning member 1 which is produced by the present embodiment includes a sheet with slits 7, but a cleaning member which is produced by another embodiment does not contain the sheet with slits 7. Further, in the cleaning member 1 which is produced by the present embodiment, the receiving parts 14 are positioned on the surface of the cleaning member 1, but in a cleaning member which is produced by another embodiment, the order of lamination of the substrate sheet 12 and the holding sheet 13 and the fibrous members 3 to 6 is changed so that the receiving parts 14 are arranged between any adjoining fibrous members 3 to 6. Due to this, the two surfaces of the cleaning member 1 can be used for cleaning. At this time, to facilitate insertion of the insert parts 16 to the receiving parts 14, the dimensions of the substrate sheet 12 and the holding sheet 13 in the long direction (up-down direction in FIG. 3) are preferably made longer than the fibrous members 3 to 6, but these dimensions may be freely determined. Further, at this time, the sheet with slits 7 need not be used. Sheet with slits 7 may also be arranged at the two surfaces of the cleaning member 1.

[0111] FIG. 5 is a view which shows an embodiment of a method of production/system of production of the present invention which shows a step of conveying a first fiber bundle F1, a step of conveying a multilayer web S1 (belt-shaped nonwoven fabric), a step of laminating the first fiber bundle and multilayer web S1 (belt-shaped nonwoven fabric) to form a multilayer web S2, and a step of fastening the multilayer web S2. It will be understood that the tension of the fiber bundle in the step of conveying the first fiber bundle F1 is lower than the tension of the multilayer web S1 (belt-shaped nonwoven fabric) in the step of conveying the multilayer web S1 (belt-shaped nonwoven fabric).

[0112] The present application claims the benefit of the following patent applications, the entire disclosures of which are incorporated herein by reference:

[0113] (1) JP Patent Application No. 2012-289181 filed on Dec. 29, 2012, and US patent application claiming priority thereof (filed on the same day as the present application),
[0114] (2) JP Patent Application No. 2012-289182 filed on Dec. 29, 2012, and US patent application claiming priority thereof (filed on the same day as the present application),
[0115] (3) JP Patent Application No. 2012-289174 filed on Dec. 29, 2012, and US patent application claiming priority thereof (filed on the same day as the present application),
[0116] (4) JP Patent Application No. 2012-289189 filed on Dec. 29, 2012, and US patent application claiming priority thereof (filed on the same day as the present application),
[0117] (5) JP Patent Application No. 2012-289175 filed on Dec. 29, 2012, and US patent application claiming priority thereof (filed on the same day as the present application),
[0118] (6) JP Patent Application No. 2012-289188 filed on Dec. 29, 2012 and US patent application claiming priority thereof (filed on the same day as the present application),
[0119] (7) JP Patent Application No. 2012-289179 filed on Dec. 29, 2012, and US patent application claiming priority thereof (filed on the same day as the present application),
[0120] (8) JP Patent Application No. 2012-289177 filed on Dec. 29, 2012, and US patent application claiming priority thereof (filed on the same day as the present application),
[0122] (10) JP Patent Application No. 2012-289178 filed on Dec. 29, 2012, and US patent application claiming priority thereof (filed on the same day as the present application),
[0124] (12) JP Patent Application No. 2013-002855 filed on Jan. 10, 2013, and US patent application claiming priority thereof (filed on the same day as the present application), as well as

REFERENCE SIGNS LIST

[0126] 1 . . . cleaning member, 2 . . . brush sheet (shaggy brush sheet), 3 . . . first fibrous member, 4 . . . second fibrous member, 5 . . . third fibrous member, 6 . . . fourth fibrous member, 7 . . . sheet with slits, 8 . . . first melt bonded part, 11 . . . second melt bonded part, 12 . . . substrate sheet, 13 . . . holding sheet, 14 . . . receiving part, 15 . . . handle, 16 . . . insert part, 16a . . . projection, 17 . . . holder, 18 . . . melt bonding line, 20 . . . reed-shaped part, 20a . . . slit, 100 . . . cleaning member production system, 102a, b . . . first nip roll, 104 . . . tension roll, 106a, b . . . second nip roll, 108 . . . air feeder, 110 . . .
transfer roll, 112a, b... third nip roll, 113 ... blade member, 114 ... oil agent tank, 120, 122, 150 ... nonwoven fabric roll, 121, 123, 151 ... belt-shaped nonwoven fabric, 124, 126, 152 ... dancer roll, 128, 132, 136, 138, 140, 156 ... merging part, 130 ... cutter, 134 ... second melt bonded part forming device, 154 ... gather roll, 158 ... first melt bonded part forming device, 160 ... cut device

1. A method of producing a cleaning member which is obtained from a multilayer web which contains at least a fiber bundle and a belt-shaped nonwoven fabric, the method of producing the cleaning member including
   a step of conveying the fiber bundle,
   a step of conveying the belt-shaped nonwoven fabric,
   a step of overlaying the conveyed fiber bundle and the conveyed belt-shaped nonwoven fabric to form the multilayer web, and
   a step of fastening the multilayer web,
   a tension of the fiber bundle in the step of conveying the fiber bundle being lower than a tension of the belt-shaped nonwoven fabric in the step of conveying the belt-shaped nonwoven fabric, and a strength of fastening of the multilayer web being adjusted by the tension of the fiber bundle and the tension of the belt-shaped nonwoven fabric.

2. The method as set forth in claim 1, wherein, in the step of conveying the fiber bundle, the fiber bundle is conveyed substantially straight.

3. The method as set forth in claim 1, wherein, in the step of conveying the belt-shaped nonwoven fabric, the belt-shaped nonwoven fabric is conveyed substantially straight.

4. The method as set forth in claim 1, wherein, in the step of conveying the fiber bundle, the fiber bundle is conveyed with the length of the fiber bundle in the width direction substantially constant.

5. The method as set forth in claim 1, wherein, in the step of conveying the belt-shaped nonwoven fabric, the belt-shaped nonwoven fabric is conveyed with the length of the belt-shaped nonwoven fabric in the width direction substantially constant.

6. The method as set forth in claim 5, wherein the step of fastening the multilayer web is a step of melt bonding.

7. The method as set forth in claim 1, wherein the fiber bundle is an opened fiber bundle.

8. The method as set forth in claim 1, wherein the method further includes a step of cutting the multilayer web in the width direction.

9. A system of producing a cleaning member which is obtained from a multilayer web including a fiber bundle and a belt-shaped nonwoven fabric, the system of producing a cleaning member being a system provided with at least a device which conveys the fiber bundle,
   a device which conveys the belt-shaped nonwoven fabric,
   a device which overlays the conveyed fiber bundle and the conveyed belt-shaped nonwoven fabric to form the multilayer web, and
   a device which fastens the multilayer web,
   a tension of the fiber bundle at the device which conveys the fiber bundle is lower than a tension of the belt-shaped nonwoven fabric at the device which conveys the belt-shaped nonwoven fabric, and a strength of fastening of the multilayer web is adjusted by the tension of the fiber bundle and the tension of the belt-shaped nonwoven fabric.

10. The system as set forth in claim 9, wherein the system is further provided with a device which cuts the multilayer web in the width direction.

* * * * *