

Description

Title of Invention

METHOD FOR PRODUCING ROLLER FOR ASSISTING MOVEMENT OF SUCTION TOOL

Technical Field

[0001] The present invention relates to a method for producing a roller configured to assist movement of a suction tool attached to a suction-type cleaning machine.

Background Art

[0002] A suction tool is attached to a suction-type cleaning machine. The cleaning machine is used with the suction tool being moved on a floor surface. In order to assist movement of the suction tool, a roller is attached to a lower surface of the suction tool.

[0003] If an outer circumferential surface of the roller is too hard, the roller damages a floor surface. Therefore, a rubber roller is generally used. When the roller has an outer circumferential surface made of only rubber, a friction coefficient of the outer circumferential surface of the roller becomes excessively large. When the friction coefficient is excessively large, the roller does not skid, or sliding of the roller in the axial direction of the roller is not allowed. This results in a difficulty in a lateral movement of the suction tool.

[0004] Patent Literature 1 proposes forming a roller by impregnating a nonwoven fabric with rubber to reduce a friction coefficient of the roller. In this case, resin fibers of the nonwoven fabric are exposed on an outer circumferential surface of the roller, and thus reduces the friction coefficient due to the exposed resin fibers.

[0005] The outer circumferential surface of the roller of Patent Literature 1 is microscopically in a state where the resin fibers are fluffy. In this case, dust on a floor surface is likely to be entangled with the resin fibers. When the dust is entangled with the roller, the roller is hindered from rotating by the dust, so that a function of assisting movement of the suction tool is lost.

Citation List

Patent Literature

[0006] Patent Literature 1: JP 2000-343903 A

Summary of Invention

[0007] It is an object of the present invention to provide a technique for reducing entanglement of dust on a roller.

[0008] A method for producing a roller in the present disclosure is used for producing a roller configured to assist movement of a suction tool attached to a suction-type cleaning machine. The method for producing a roller includes: a heating step of heating an outer surface of a roller-shaped member including a roller body made of rubber and resin fibers, which are scattered on and protrude from an outer circumferential surface of the roller body, to melt the resin fibers protruding from the outer circumferential surface of the roller body and form resin parts on the outer circumferential surface of the roller body; and a solidifying step of solidifying the melted resin parts.

[0009] The roller produced by the afore-mentioned producing method may reduce entanglement of dust on the roller.

[0010] Detailed description and accompanying drawings below more clarify objects, features, and advantages of the present invention.

Brief Description of Drawings

[0011] FIG. 1 is a side view of a suction-type cleaning machine to which a suction tool is attached, the suction tool including a roller produced by a method for producing a roller according to the present embodiment.

FIG. 2 is a plan view of the suction tool in FIG. 1.

FIG. 3 is a sectional view taken along line III-III of FIG. 2.

FIG. 4 is a bottom view of the suction tool shown in FIG. 2.

FIG. 5 is a perspective view of a roller produced by the method for producing a roller according to the present embodiment.

FIG. 6 is a diagram showing a state in which a resin part formed on an outer circumferential surface of a roller body is connected to an inner resin part in the roller body of the roller produced by the method for producing a roller according to the present embodiment.

FIG. 7 is a diagram showing the method for producing a roller according to the present embodiment.

Description of Embodiments

[0012] Although an embodiment will be described in detail below with reference to the drawings, detailed description of already well-known matters or duplicated description of a substantially identical configuration, for example, may be omitted to facilitate understanding of those skilled in the art. The accompanying drawings and the following description are provided for those skilled in the art to fully understand the present disclosure, and are not intended to limit the subject matter described in the claims.

[0013] FIG. 1 shows a suction-type cleaning machine 101 to which a suction tool 100 is attached. The cleaning machine 101 includes a body 102 incorporating a suction fan (not shown) and a motor (not shown) for driving the suction fan, and a hose 103 extending from the body 102. The cleaning machine 101 further includes an operation portion 104 provided at an intermediate position of the hose 103. The suction tool 100 is connected to a distal end of the hose 103. The operation portion 104 is electrically connected to the body 102 and the suction tool 100 through wiring provided along the hose 103. The operation portion 104 is configured to generate a command signal for actuating or stopping drive parts of the body 102 and the suction tool 100 in response to an operation of a user.

[0014] As shown in FIGS. 2 to 4, the suction tool 100 includes a housing 120 having a hollow box structure elongated in a left-right direction, and a connection port 130 configured to connect the housing 120 to the distal end of the hose 103. In the housing 120, there are two scraping rollers 141, 142 for scraping off dust. The housing 120 is provided on its lower surface with multiple

rollers 151 to 153.

[0015] The housing 120 includes a front wall 121, a rear wall 122, side walls 123, 124, an upper wall 125, a lower wall 126, a front cover 129, and a partition wall 127.

[0016] The front wall 121 is a part standing at the front side of the housing 120. The rear wall 122 is a part standing behind the front wall 121 and is long in the left-right direction. The rear wall 122 is provided with a recess 122a that is recessed forward at the central position of the rear wall 122 in the left-right direction (see FIG. 2).

[0017] The side walls 123, 124 are parts standing at the right side and the left side of the housing 120, respectively, and connect the front wall 121 and the rear wall 122. The upper wall 125 is connected to an upper part of the rear wall 122 and an upper part of each of the side walls 123, 124.

[0018] The lower wall 126 constitutes the lower surface of the housing 120, and is formed in a substantially C shape opened forward in a bottom view as shown in FIG. 4. In detail, the lower wall 126 has left and right lower walls 126a, 126a protruding from the side walls 123, 124, respectively, in a width direction of the suction tool 100, and a rear lower wall 126b protruding forward from the rear wall 122. The left and right lower walls 126a, 126a are equal in length to the side walls 123, 124, respectively, in a front-rear direction. The rear lower wall 126b is extended from the left lower wall 126a to the right lower wall 126a. The rear lower wall 126b is provided on its lower surface with a dust collecting part 128 formed of a raised fabric having a fluffy surface.

[0019] The front cover 129 is connected to an upper part of the front wall 121, an upper part of the upper wall 125, and the side walls 123, 124, and is configured to be attachable to the upper part of the front wall 121 and the upper part of the upper wall 125.

[0020] The partition wall 127 includes partition wall parts 127a extending in the front-rear direction and a partition wall part 127b extending in the left-right direction. The partition wall parts 127a extend from respective inner ends of the left and right lower walls 126a, 126a to the upper wall 125. The partition wall part 127b extend from an inner end of the rear lower wall 126b to the upper wall 125. The partition wall part 127b is continuous over the entire length of the rear lower wall 126b in the left-right direction. The partition wall parts 127a extend from respective left and right ends of the partition wall part 127b to front ends of the respective left and right lower walls 126a, 126a.

[0021] The suction tool 100 is provided with a suction space 111 into which dust is to be sucked. The suction space 111 is defined by the partition wall 127 and the front cover 129. The suction space 111 opens downward, and has a substantially rectangular opening. The suction space 111 is a space into which dust on a floor surface flows together with air.

[0022] The suction tool 100 is provided with a housing space 112 in which motors 165, 167 are housed to drive scraping roller 141, 142, respectively (see FIGS. 2 to 4). The housing space 112 is partitioned by the partition wall 127. In detail, the housing space 112 is defined by the partition wall 127, the rear wall 122, the side walls 123, 124, the upper wall 125, and the lower wall 126.

[0023] The housing 120 is provided with a flow path 116 passing through the partition wall 127 and

a recess 122a of the rear wall 122 (see FIGS. 2 to 4). The flow path 116 is provided on its front side with an opening 115 that is formed at a central position in the left-right direction of the partition wall 127, so that the flow path 116 opens toward the suction space 111 (see FIG. 4). The flow path 116 extends rearward from the opening 115 on the front side and is connected to the connection port 130. The flow path 116 is used as a flow path through which air and dust flow from the suction space 111 to the cleaning machine 101.

[0024] As shown in FIGS. 2 and 4, the rear lower wall 126b is provided with a rear bracket 158 at the central position of the rear lower wall 126b in the left-right direction, the rear bracket 158 protruding rearward. The rear bracket 158 is formed integrally with the rear lower wall 126b. The rear bracket 158 has a substantially U-shape opened rearward in plan view. In detail, the rear bracket 158 includes a proximal end part 158a adjacent to the rear lower wall 126b, and left and right protrusions 158b, 158b protruding rearward, respectively, from left and right end parts at a rear end of the proximal end part 158a. Each of the left and right protrusions 158b, 158b is provided with corresponding one of housing holes 159, 159 that are recessed upward from a lower surface of the rear bracket 158, the respective rollers 153, 153 being housed in the housing holes 159, 159.

[0025] The housing holes 159, 159 may vertically extend through the left and right protrusions 158b, 158b, respectively. The rear bracket 158 may not be formed integrally with the rear lower wall 126b as long as it protrudes rearward from the lower surface of the housing 120, and the shape thereof is not limited. Additionally, the number of rollers 153 is not limited to two. The rear bracket 158 may be omitted.

[0026] The scraping roller 141 is disposed in the suction space 111 (see FIG. 4). The scraping roller 141 includes a tapered tubular part 161 and multiple scrapers 162 provided on an outer circumferential surface of the tapered tubular part 161. The tapered tubular part 161 has a proximal end situated in the housing space 112 near the side wall 123. The tapered tubular part 161 laterally extends through the partition wall part 127a (right side in FIG. 4).

[0027] The tapered tubular part 161 is slightly shorter than half the length of the suction space 111 in the left-right direction. The tapered tubular part 161 is rotatably supported at its proximal end part with a bearing (not shown) disposed in the housing space 112 near the side wall 123.

[0028] The tapered tubular part 161 has a truncated conical shape that tapers and is elongated from the proximal end toward the distal end. The tapered tubular part 161 is inclined from the proximal end to the distal end so that the distal end is situated at a front position with respect to the proximal end. Additionally, the tapered tubular part 161 is inclined so that the distal end is situated at a lower position than the proximal end.

[0029] The tapered tubular part 161 is provided with a pulley (not shown) at the proximal end of the tapered tubular part 161, the pulley being attached to the tapered tubular part 161 so that the pulley rotates integrally with the tapered tubular part 161. From the pulley to a motor shaft 165b of a motor 165 situated in the housing space 112, a belt 166 (see FIG. 3) is extended so that the scraping roller 141 is rotated and driven by the motor 165.

[0030] The multiple scrapers 162 are configured to scrape off dust on a floor surface. Each of the multiple scrapers 162 is a band part spirally extending over a section from the proximal end to the distal end of the tapered tubular part 161. Each scraper 162 is made of an elastically deformable material. For example, the scraper 162 may be formed by using a large number of brush bristles, an elastomer band or an elastic resin band, or a cloth material band.

[0031] The scraper 162 protrudes from an outer circumferential surface of the tapered tubular part 161 with a substantially uniform protrusion size over a section from the proximal end to the distal end of the tapered tubular part 161. The protrusion size of the scraper 162 is set to a value at which the scraper 162 protrudes downward from the lower surface of the housing 120 through the suction space 111 and comes into contact with the floor surface.

[0032] The scraper 162 is not parallel to the central axis of the tapered tubular part 161. In detail, the scraper 162 extends in a direction twisted around the central axis of the tapered tubular part 161. In short, the distal end and the proximal end of the scraper 162 are situated at different positions from each other in the circumferential direction of the tapered tubular part 161.

[0033] The scraping roller 142 is bilaterally symmetrical with the scraping roller 141. In short, the distal end of the scraping roller 142 faces the distal end of the scraping roller 141. The scraping roller 142 extends laterally from the distal end of the scraping roller 142 toward the side wall 124. The scraping roller 142 is rotatably supported at a vicinity of the proximal end of the tapered tubular part 161 by a bearing (not shown) situated in the housing space 112 near the side wall 124. A pulley is attached to the proximal end of the scraping roller 142 of the tapered tubular part 161 so that the pulley rotates integrally with the tapered tubular part 161. From the pulley to a motor shaft 167b of a motor 167, a belt 168 is extended so that the scraping roller 142 is rotated and driven by the motor 167.

[0034] The scraping rollers 141, 142 are each slightly shorter than half of the length of the suction space 111 in the left-right direction, so that a gap 118 is formed between the distal ends of the scraping rollers 141, 142 (see FIG. 4). In short, the gap 118 is formed adjacent to the distal ends of the scraping rollers 141, 142 in extending directions of the corresponding scraping rollers 141, 142. The scraping rollers 141, 142 each have a symmetrical shape with respect to the gap 118. The gap 118 is used to remove long dust (e.g., hair) wound around each of the scraping rollers 141, 142.

[0035] The gap 118 is formed in front of the opening 115 of the flow path 116 (see FIGS. 2 and 4). In detail, the gap 118 is aligned with the opening 115 in an opening direction of the flow path 116. The gap 118 is formed substantially at the center of the suction space 111 in the left-right direction.

[0036] The motor 165 is supported by a motor support part 176 provided on an upper surface of the lower wall 126 so that the motor shaft 165b becomes in parallel to the central axis of the tapered tubular part 161 of the scraping roller 141 (see FIG. 3). The motor 167 is supported by a motor support part 176 provided on an upper surface of the lower wall 126 so that the motor shaft 167b becomes in parallel to the rotation axis of the tapered tubular part 161 of the scraping roller 142 (see

FIG. 3).

[0037] As shown in FIG. 4, the left and right rollers 151, 151 are situated on the left and right lower walls 126a, 126a, respectively. The rear lower wall 126b is provided with a friction reduction roller 152. The rear bracket 158 is provided with a pair of the rear rollers 153, 153. When the rear bracket 158 is omitted, the pair of the rear rollers 153, 153 may be omitted.

[0038] The left and right rollers 151, 151 are each formed by impregnating a nonwoven fabric with rubber. Therefore, resin fibers are interspersed inside each of the rollers 151, 151, and a part of the resin fibers has a fluffy state on an outer surface of each of the rollers 151, 151. The material of the left and right rollers 151, 151 is not limited. For example, the left and right rollers 151, 151 may be made of resin.

[0039] The left and right rollers 151, 151 are situated in left and right roller placement holes 156, 156 formed in the left and right lower walls 126a, 126a, respectively. The rollers 151, 151 are rotatably attached to the left and right lower walls 126a, 126a, respectively. In this condition, the left and right rollers 151, 151 protrude downward from lower surfaces of the left and right lower walls 126a, 126a, respectively.

[0040] The pair of the rear rollers 153, 153 is formed by impregnating a nonwoven fabric with rubber. Therefore, resin fibers are interspersed inside each of the rear rollers 153, 153, and a part of the resin fibers has a fluffy state on an outer surface of each of the rear rollers 153, 153. The material of the pair of the rear rollers 153, 153 is not limited. For example, the pair of the rear rollers 153, 153 may be made of resin.

[0041] The pair of the rear rollers 153, 153 is situated in the housing holes 159, 159 of the left and right protrusions 158b, 158b, respectively. The rear rollers 153, 153 are rotatably attached to the left and right protrusions 158b, 158b, respectively. In this condition, the pair of the rear rollers 153, 153 protrudes downward from lower surfaces of the left and right protrusions 158b, 158b, respectively.

[0042] As shown in FIGS. 5 and 6, the friction reduction roller 152 includes a rubber roller body 152a, resin parts 152b being scattered substantially uniformly on an outer surface of the roller body 152a, and a fibrous inner resin part 152c situated inside the roller body 152a. The inner resin part 152c is connected to the resin parts 152b on the outer surface of the roller body 152a. The friction reduction roller 152 is formed by using a roller-shaped member in which resin fibers are interspersed in the roller body 152a and a part of the resin fibers has a fluffy state on the outer surface.

[0043] The roller body 152a is made of nitrile butadiene rubber (NBR). The rubber forming the roller body 152a is not limited to nitrile butadiene rubber (NBR).

[0044] The resin part 152b is made of polyester. The material of the resin part 152b is not limited to polyester as long as it can be melted by heating and has a lower friction coefficient than the rubber forming the roller body 152a. For example, the material of the resin part 152b may be polypropylene or polyethylene.

[0045] An outer circumferential surface of the friction reduction roller 152 is formed by an outer circumferential surface of the roller body 152a and the resin parts 152b which are scattered on the outer circumferential surface of the roller body 152a. Therefore, irregularities are microscopically formed on the outer circumferential surface of the friction reduction roller 152. The outer circumferential surface of the friction reduction roller 152 has surface roughness that is set to prevent dust from entering the irregularities on the outer circumferential surface of the friction reduction roller 152. In detail, the outer circumferential surface of the friction reduction roller 152 is formed with a surface roughness with a maximum height Sz of less than 150 μm . The maximum height Sz means a height difference between the highest point and the lowest point on the outer circumferential surface of the friction reduction roller 152. The highest point on the outer circumferential surface of the friction reduction roller 152 is formed of the resin parts 152b, so that the maximum height Sz may mean a height difference between the highest point of the resin parts 152b and the lowest point of the outer circumferential surface of the roller body 152a.

[0046] The resin parts 152b are scattered not only on the outer circumferential surface of the roller body 152a but also on side surfaces of the roller body 152a. The resin parts 152b on the side surfaces of the roller body 152a are formed to cause the side surfaces of the friction reduction roller 152 to have a surface roughness with a maximum height Sz of less than 150 μm . The resin parts 152b on the side surfaces of the roller body 152a may be omitted.

[0047] The friction reduction roller 152 is disposed in a placement hole 157 formed in the rear lower wall 126b. The friction reduction roller 152 is rotatably attached to the rear lower wall 126b. In this condition, the friction reduction roller 152 protrudes downward from a lower surface of the rear lower wall 126b. The placement hole 157 is situated at a position closer to the opening 115 of the flow path 116 than the left and right roller placement holes 156, 156 (see FIGS. 3 and 4).

[0048] Next, a method for producing the friction reduction roller 152 of the afore-mentioned suction tool 100 is described with reference to FIG. 7. FIG. 7 does not show the resin parts 152b.

[0049] First, a roller-shaped member 10 is produced. The roller-shaped member 10 includes a roller body 152a made of rubber. Resin fibers protrude from and scatter on an outer circumferential surface and a side surface of the roller body 152a. The protrusion size of the resin fibers from the outer circumferential surface and the side surface of the roller body 152a is set such that the outer circumferential surface of the friction reduction roller 152 as a final product has a surface roughness with a maximum height Sz of less than 150 μm .

[0050] The roller-shaped member 10 may be produced, for example, by impregnating an annular nonwoven fabric made of resin such as polyester with resin such as nitrile butadiene rubber (NBR). In this case, a part of the resin fibers of the nonwoven fabric may be exposed on the outer circumferential surface and the side surface of the roller body 152a while having a fluffy state. The resin fibers protruding on the outer circumferential surface and the side surfaces of the roller body 152a in this state are connected to the inner resin part 152c that is the nonwoven fabric inside the roller-shaped member 10.

[0051] When no resin part 152b is formed on the side surfaces of the roller body 152a, the resin fibers may not protrude from the side surfaces of the roller body 152a in the roller-shaped member 10.

[0052] Subsequently, an outer surface of the roller-shaped member 10 is heated by combustion gas at temperature exceeding 250°C with a burner 170 as shown in FIG. 7. The heating temperature is higher than melting points of the resin fibers and the roller body 152a. Consequently, the roller body 152a and the resin fibers protruding from the outer circumferential surface and side surfaces of the roller body 152a are melted. When the resin fibers which are scattered on the outer circumferential surface and the side surfaces of the roller body 152a are melted, melted resin parts 152b are formed and scattered on the outer circumferential surface and the side surfaces of the roller body 152a. At this time, the resin parts 152b on the outer circumferential surface and the side surfaces of the roller body 152a are kept connected to the inner resin part 152c inside the roller body 152a. The surfaces of the roller body 152a are also melted, so that the roller body 152a itself decreases in surface roughness.

[0053] At this time, discharge pressure of the combustion gas generated from the burner 170 is adjusted to allow each of the outer circumferential surface and the side surfaces of the friction reduction roller 152 to have a surface roughness with a maximum height S_z of less than 150 μm after the heating step. For example, an increase in the discharge pressure of the combustion gas from the burner 170 causes the combustion gas to press the melted resin parts 152b toward the outer circumferential surface and the side surfaces of the roller body 152a with a strong force. As a result, the protrusion size of the resin parts 152b from the outer circumferential surface and the side surfaces of the roller body 152a decreases, so that the outer circumferential surface and the side surfaces of the friction reduction roller 152 decrease in the maximum height S_z of the surface roughness. Under this condition, an area occupied by the resin parts 152b melted on the outer circumferential surface and the side surfaces of the roller body 152a becomes wide, so that a friction coefficient on an outer surface of the friction reduction roller 152 decreases.

[0054] Conversely, a decrease in the discharge pressure of the combustion gas from the burner 170 results in a decrease in the force pressing the resin parts 152b toward the outer circumferential surface and the side surfaces of the roller body 152a. As a result, the protrusion size of the resin parts 152b from the outer circumferential surface and the side surfaces of the roller body 152a becomes large, so that the outer circumferential surface and the side surfaces of the friction reduction roller 152 increase in the maximum height S_z of the surface roughness. Under this condition, the area occupied by the resin parts 152b on the outer circumferential surface and the side surfaces of the roller body 152a becomes narrow, so that the friction coefficient on the outer circumferential surface and the side surfaces of the friction reduction roller 152 increases.

[0055] Eventually, a solidifying step of solidifying the melted resin parts 152b is executed. In the solidifying step, the melted resin parts 152b is naturally cooled, and changed from a melted state to a solidified state. As a result, the solidified resin parts 152b are formed and scattered on the outer

circumferential surface and the side surfaces of the roller body 152a.

[0056] Means for heating the outer surface of the roller-shaped member 10 is not limited to the burner 170 as long as it can melt the resin fibers protruding from the outer surface of the roller body 152a of the roller-shaped member 10. It may depend on a type of the resin fibers how high the temperature is set to heat the outer surface of the roller-shaped member 10 as long as the temperature is higher than the melting point of the resin fibers. Although the heating temperature is set to a value higher than the melting points of the resin fibers and the roller body 152a in the afore-mentioned embodiment, the heating temperature may be set to a value higher than the melting point of the resin fibers and lower than the melting point of the roller body 152a.

[0057] In the afore-mentioned method for producing the friction reduction roller 152, the outer surface of the roller-shaped member 10 is heated. The roller-shaped member 10 includes the roller body 152a made of rubber, and the resin fibers protrude from the outer surface of the roller body 152a. The resin fibers are scattered on the outer surface of the roller body 152a. The resin fibers on the outer surface of the roller body 152a are melted in the heating step of heating the outer surface of the roller-shaped member 10, and then are solidified. As a result, the resin parts 152b are formed and scattered on the outer surface of the roller-shaped member 10. The protrusion size of the resin parts 152b from the outer surface of the roller body 152a is smaller than the protrusion size of the resin fibers from the outer surface of the roller body 152a before the heating step.

Accordingly, dust is less likely to be entangled on the roller body 152a. In short, melting the resin fibers solves the problem of capturing dust caused by fluffing of the resin fibers. Accordingly, rolling failure of the roller due to adhesion of dust to the roller is suppressed.

[0058] In the afore-mentioned method for producing the friction reduction roller 152, the outer circumferential surface of the friction reduction roller 152 has a surface roughness with a maximum height S_z of less than 150 μm . The maximum height S_z is smaller than an average thickness (150 μm) of hair, so that the hair is less likely to enter irregularities on the outer circumferential surface of the roller.

[0059] In the afore-mentioned method for producing the friction reduction roller 152, the resin parts 152b on the outer circumferential surface of the roller body 152a are connected to the inner resin part 152c inside the roller body 152a after the heating step. Accordingly, the resin parts 152b are less likely to peel off from the outer circumferential surface of the roller body 152a.

[0060] In the afore-mentioned method for producing the friction reduction roller 152, the outer surface of the roller-shaped member 10 is heated at a temperature exceeding 250°C. The heating temperature is higher than the melting point of the resin fibers made of polyester, so that the resin fibers are melted on the outer circumferential surface and the side surfaces of the roller body 152a to form the resin parts 152b. Then, when the resin parts 152b are solidified, the resin parts 152b adhere to the outer circumferential surface and the side surfaces of the roller body 152a. The outer surface of the roller body 152a is partially covered with the resin parts 152b, so that the friction coefficient of the friction reduction roller 152 becomes small.

[0061] In the afore-mentioned method for producing the friction reduction roller 152, the outer surface of the roller-shaped member 10 is heated at a temperature higher than that of the roller body 152a made of NBR. Accordingly, not only the resin fibers but also the roller body 152a is melted. This causes also a decrease in roughness of a surface of rubber appearing on the surface of the roller body 152a.

[0062] In the afore-mentioned method for producing the friction reduction roller 152, the resin parts 152b are formed not only on the outer circumferential surface of the roller body 152a but also on the roller body 152a. Accordingly, dust is less likely to adhere not only to the outer circumferential surface of the roller body 152a but also to the side surfaces of the roller body 152a.

[0063] The embodiment described above mainly includes the following features.

[0064] A method for producing a roller in the present disclosure is used for producing a roller configured to assist movement of a suction tool attached to a suction-type cleaning machine. The method for producing a roller includes: a heating step of heating an outer surface of a roller-shaped member including a roller body made of rubber and resin fibers, which are scattered on and protrude from an outer circumferential surface of the roller body, to melt the resin fibers protruding from the outer circumferential surface of the roller body and form resin parts on the outer circumferential surface of the roller body; and a solidifying step of solidifying the melted resin parts.

[0065] According to the afore-mentioned configuration, the outer surface of the roller-shaped member is heated in the heating step. The roller-shaped member includes the roller body made of rubber and the resin fibers protruding from the outer circumferential surface of the roller body. The resin fibers on the outer circumferential surface of the roller body are melted and become melted resin parts by heating the outer surface of the roller-shaped member. Since the resin fibers are scattered on the outer circumferential surface of the roller body, the melted resin parts are also scattered on the outer circumferential surface of the roller body. The protrusion size of the resin parts from the outer circumferential surface of the roller body is smaller than the protrusion size of the resin fibers from the outer circumferential surface of the roller body, so that dust is less likely to entangle on the roller body. In short, melting the resin fibers solves the problem of capturing dust caused by fluffing of the resin fibers. Thus, rolling failure of the roller due to adhesion of dust to the roller is suppressed.

[0066] In the afore-mentioned configuration, in the heating step, the outer circumferential surface of the roller body may be heated to cause the outer circumferential surface of the roller to have a surface roughness with a maximum height S_z of less than 150 μm after the solidifying step.

[0067] According to the afore-mentioned configuration, the outer circumferential surface of the roller after the solidifying step has a surface roughness with a maximum height S_z of less than 150 μm . The maximum height S_z represents a height difference between the highest point and the lowest point on the outer circumferential surface of the roller. The highest point on the outer circumferential surface of the roller is formed of the resin part, so that the maximum height S_z

indicates a height difference between the highest point of the resin parts and the lowest point of the outer circumferential surface of the roller body. The maximum height S_z is smaller than an average thickness (150 μm) of hair, so that the hair is less likely to enter irregularities on the outer circumferential surface of the roller.

[0068] In the afore-mentioned configuration, the roller-shaped member may include a fibrous inner resin part situated inside the roller body. The resin fibers may be connected to the inner resin part. In the heating step, the outer circumferential surface of the roller body may be heated while the resin fibers are kept connected to the inner resin part.

[0069] According to the afore-mentioned configuration, the resin parts on the outer circumferential surface of the roller body are kept connected to the fibrous inner resin part situated inside the roller body, so that the resin parts are less likely to peel off from the outer circumferential surface of the roller body.

[0070] In the afore-mentioned configuration, the resin fibers may be made of polyester. In the heating step, the outer surface of the roller-shaped member may be heated at a temperature exceeding 250°C.

[0071] According to the afore-mentioned configuration, the heating temperature for the outer surface of the roller-shaped member exceeds 250°C. Since this temperature is higher than the melting point of the polyester forming the resin fibers, the resin fibers made of the polyester may be melted and form the resin parts on the outer surface of the roller body. Since the resin parts made of the polyester are scattered on the outer surface of the roller body, the friction coefficient of the roller becomes small.

[0072] In the afore-mentioned configuration, the roller body may be made of nitrile butadiene rubber (NBR).

[0073] According to the afore-mentioned configuration, the roller body is melted together with the resin fibers because NBR has a melting point lower than the heating temperature exceeding 250°C. This causes a decrease in roughness of a surface of rubber appearing on the surface of the roller body.

[0074] In the afore-mentioned configuration, the roller-shaped member may have resin fibers which are scattered on and protrude from side surfaces of the roller body. In the heating step, the outer surface of the roller-shaped member may be heated to melt the resin fibers protruding from the side surfaces and form melted resin parts on the side surfaces of the roller body. The resin parts on the side surfaces of the roller body may be solidified in the solidifying step.

[0075] According to the afore-mentioned configuration, the roller also has resin parts which are scattered on the side surfaces of the roller body. In this case, dust is less likely to entangle on the roller as compared with a configuration in which the resin parts are formed only on the outer circumferential surface of the roller body.

Industrial Applicability

[0076] The method for producing a roller according to the present embodiment is suitably used for

an apparatus used for cleaning work.

Claims

1. A method for producing a roller configured to assist movement of a suction tool attached to a suction-type cleaning machine, the method comprising:
 - a heating step of heating an outer surface of a roller-shaped member including a roller body made of rubber and resin fibers, which are scattered on and protrude from an outer circumferential surface of the roller body, to melt the resin fibers protruding from the outer circumferential surface of the roller body and form resin parts on the outer circumferential surface of the roller body; and
 - a solidifying step of solidifying the melted resin parts.
2. The method for producing a roller according to claim 1, wherein in the heating step, the outer circumferential surface of the roller body is heated to cause the outer circumferential surface of the roller to have a surface roughness with a maximum height S_z of less than 150 μm after the solidifying step.
3. The method for producing a roller according to claim 1 or 2, wherein
 - the roller-shaped member includes a fibrous inner resin part situated inside the roller body, the resin fibers are connected to the inner resin part, and
 - in the heating step, the outer circumferential surface of the roller body is heated while the resin fibers are kept connected to the inner resin part.
4. The method for producing a roller according to any one of claims 1 to 3, wherein
 - the resin fibers are made of polyester, and
 - in the heating step, the outer surface of the roller-shaped member is heated at a temperature exceeding 250°C.
5. The method for producing a roller according to claim 4, wherein the roller body is made of nitrile butadiene rubber (NBR).
6. The method for producing a roller according to any one of claims 1 to 5, wherein
 - the roller-shaped member has resin fibers which are scattered on and protrude from side surfaces of the roller body,
 - in the heating step, the outer surface of the roller-shaped member is heated to melt the resin fibers protruding from the side surfaces and form melted resin parts on the side surfaces of the roller body, and
 - the resin parts on the side surfaces of the roller body are solidified in the solidifying step.