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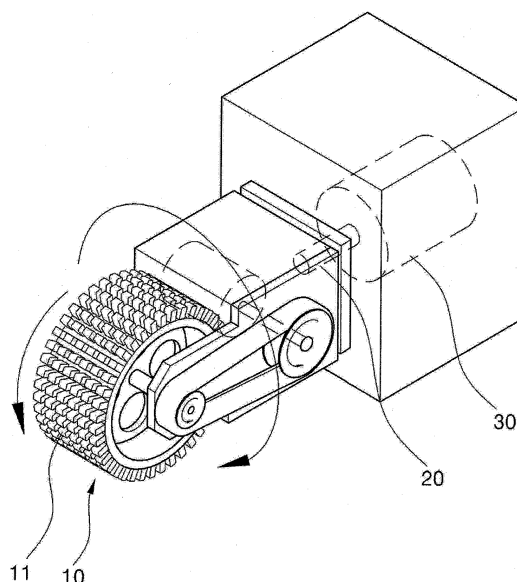
(71) Applicant: **Best Whasung Co., Ltd.**
Paju, Gyunggi-do 413-836 (KR)

(72) Inventors:
• **KWON, Young-jun**
Gyunggi-do 413-835 (KR)
• **KWON, Sung-wook**
Seoul 156-070 (KR)
• **KWON, Sung-hwan**
Seoul 135-080 (KR)

(74) Representative: **advotec.**
Patent- und Rechtsanwälte
Widenmayerstrasse 4
80538 München (DE)

(54) **METHOD FOR TAPERING BRISTLE OF A TOOTHBRUSH BY A MECHANICAL METHOD**

(57) The present invention relates to a method for tapering bristle of a toothbrush using grinding drums which have protrusions (11) with a height of 1.5 to 7.0mm, and which rotate in the vertical and horizontal directions, said method comprising a step of connecting the grinding drums in parallel, such that the grinding drums are arranged in sequence wherein the heights of the protrusions (11) of each of the grinding drums are gradually decreased, and a step of enabling the toothbrush with a non-tapered bristle to pass through each of the grinding drums in series such that the bristle can be ground. The method of the present invention produces highly tapered bristle having a tapered length of 5mm or longer and an end thickness of 0.02mm or less even without immersing bristle into chemicals, and prevents thermal deformations which may otherwise occur in the tapering process performed by a mechanical method.



(Fig. 1)

Description**[Technical Field]**

5 **[0001]** The present invention relates, in general, to a method of tapering the bristle of a toothbrush and, more particularly, to a method of tapering the bristle of a toothbrush by a mechanical method using grinding drums which have protrusions.

10 **[0002]** When comparing a toothbrush having needle-shaped bristles which are sharp at ends thereof with a toothbrush having ordinary bristles which are round at ends thereof, the toothbrush having the needle-shaped bristles is more excellent in softness and in its ability to penetrate between teeth or into a periodontal pocket. For the reason, recently,

[Background Art]

15 **[0003]** Methods of manufacturing a needle-shaped bristle include (i) a method of dissolving the end of a bristle using strong acid or strong alkali, (ii) a method of grinding the end of a bristle using a grinder after implanting the bristle into a toothbrush, (iii) a method of performing a preliminary tapering operation using the method (i), implanting a bristle into a toothbrush, and thereafter grinding the end of the bristle using the method (ii), etc. Here, the "preliminary tapering operation" is the operation which is performed such that the end of the bristle is tapered less than a target tapered degree, in other words, the end has the thickness of about 0.03 to 0.10mm.

20 **[0004]** The method (i) can make a highly tapered needle-shaped bristle which has a relatively long tapered length of 5mm or more and an end thickness of about 0.01mm. Such a needle-shaped bristle is long in a tapered portion thereof, so that softness is excellent, and is thin in an end thereof, so that penetration ability is excellent. However, this method is problematic in that it is difficult to precisely control a dissolving time during the tapering operation, a defective ratio is high, and the working environment is very poor.

25 **[0005]** The method (ii) is excellent in terms of work efficiency, but is problematic in that the obtained needle-shaped bristle has a short tapered length of 2mm or less, so that softness is poor, and thus the gums may be damaged when a user brushes his or her teeth.

30 **[0006]** The method (iii) solves the problems of the methods (i) and (ii) to some extent, and is disclosed in Korean Patent Nos. 261658 and 421454 which were filed by the inventor of the present invention. According to Korean Patent No. 261658, a bristle is immersed and dissolved in a strong acid or strong alkali solution until shortly before the bristle gets short. Next, the bristle is washed in water and dried, and then is implanted in a head of a toothbrush. Subsequently, the end of the bristle is ground by a grinder. The needle-shaped bristle obtained by this method is advantageous in that a length of the tapered portion thereof is about 5mm which is long, so that softness is excellent. However, the needle-shaped bristle is problematic in that a thickness of the end thereof is 0.04 to 0.08mm which is relatively large, so that the ability to penetrate is low. If a grinding operation is further performed to reduce the thickness of the end, the length of the tapered portion is reduced, so that softness becomes poor.

35 **[0007]** Korean Patent No. 421454 is similar to Korean Patent No. 261658, but performs a grinding operation so that the thickness of an end is 0.02mm or less so as to improve penetration ability. Thus, this method is advantageous in that the penetration ability is excellent. However, this method is problematic in that the length of the tapered portion is only 2.8 to 3.5mm, so that softness is poor and a defective ratio is high in a manufacturing process.

40 **[0008]** In order to solve these problems, Korean Patent No. 666457 (hereinafter, referred to as "prior art") which was filed by the inventor of the present invention has been proposed.

45 **[0009]** According to the prior art, "an end of an ordinary bristle which is not tapered is ground by a drum-type grinder which includes protrusions 11 having the height of 1.5 to 7mm and the distance of 1 to 5mm therebetween, and is rotated in vertical and horizontal directions" (see Fig. 1). An end of a needle-shaped bristle obtained by this method has the diameter of 0.01 to 0.02mm, and a tapered portion of the needle-shaped bristle has the length of 3 to 7mm. The diameter of the end and the length of the tapered portion are almost equal to those of a needle-shaped bristle obtained by a chemical immersion method. The prior art provides the needle-shaped bristle having a desired end thickness and a desired tapered length without immersing the bristle in chemicals.

50 **[0010]** However, the bristle made by the prior art is problematic in that thermal deformation may occur because of heat generated during the grinding operation. The thermal deformation leads to the bending of the bristle, thus lowering quality.

55 **[0011]** In addition, according to Korean Patent Appln. No. 10-2007-7027084, a bristle is ground using a drum-type grinder having no protrusion 11 (a first grinding operation), is ground using a drum-type grinder having protrusions 11 (second and third grinding operations), and is finally finished using a rotary drum having fibers on a surface thereof (a fourth grinding operation). However, this method is also problematic in that the rotating speed of the grinder is 500 to 1500 rpm in the second grinding operation and is 1000 to 2000 rpm in the third grinding operation, so that the rotating speed is very high, and thus the thermal deformation of the obtained bristle cannot be avoided. The thermal deformation

causes the bending to the end of a tapered portion, and leads to the bristle being irregularly ground, so that the product has no marketability.

[0012] Further, in order to reduce the generation of frictional heat, there has been proposed a method of fixing a toothbrush having bristles which are to be ground and moving the grinder up and down during the grinding operation, thus reducing a frictional area. Although this method can reduce the generation of the frictional heat, frictional heat is still accumulated in a deep space between the protrusions 11. Also important is that the end of the bristle is ground less. When the end of the bristle is in contact with a bottom P between the protrusions 11 as shown in Fig. 2, the end is effectively ground. However, the method of vertically moving the grinder having the same high protrusions 11 makes it impossible to contact the end of the bristle with the bottom P. Further, it can be seen that the first and fourth grinding operations of this method are unnecessary when manufacturing the needle-shaped bristle.

[Disclosure]

[Technical Problem]

[0013] Accordingly, the present invention has been made keeping in mind the above problems occurring in the prior art, and an object of the present invention is to provide a method of tapering a bristle of a toothbrush, which tapers the bristle of the toothbrush by a mechanical method, in addition to preventing thermal deformation. Another object of the present invention is to provide a method of tapering a bristle of a toothbrush, which has improved work efficiency.

[Technical Solution]

[0014] In order to accomplish the above objects, the present invention provides a method of tapering a bristle of a toothbrush using grinding drums that have protrusions and rotate in vertical and horizontal directions, in which the grinding drums having the protrusions of different heights are continuously arranged and a toothbrush having a non-tapered ordinary bristle passes through the grinding drums in sequence, thus grinding the end of the bristle that is implanted into the toothbrush.

[0015] The "implanted toothbrush" includes a toothbrush to which bristles are fixed with an anchor and a toothbrush to which bristles are fixed without an anchor. The implanted toothbrush includes toothbrushes in which bristles are implanted in various forms and toothbrushes having bristles which are implanted and thereafter are cut in a specific shape.

[0016] Hereinafter, the present invention will be described in detail.

[0017] A grinding drum applied to the present invention is shown in Fig. 1. The grinding drum 10 has a great number of protrusions 11 on a surface thereof, and is connected to a rotor 30 via a rotating shaft 20 so that the grinding drum 10 can be rotated both vertically and horizontally.

[0018] The proper height of the protrusions 11 is 1.5mm to 7.0mm. If a bristle is ground by the grinding drum 10, a needle-shaped bristle whose tapered portion has the length of 5mm or more is obtained, as described above.

[0019] However, when a grinding operation is performed by the grinding drum 10, a lot of heat is generated, thus causing thermal deformation to the bristle. In order to prevent the thermal deformation, the method of spraying moisture may be considered. However, since this method abruptly reduces the grinding force of the grinding drum 10, it cannot be adopted.

[0020] According to the present invention, heat generated during the grinding operation is thoroughly controlled and the bristle does not undergo thermal deformation.

[0021] The method of controlling heat generated during the grinding operation uses a method of reducing the rpm of the grinding drum under a specific range and a method of controlling the height of the protrusions 11.

[0022] If the grinding drum rotates at high speed, a lot of frictional heat is generated, so that the vertical rpm must be controlled to within 200 to 500 rpm, preferably, 250 to 480 rpm. When the rpm exceeds the above range, thermal deformation occurs. In contrast, when the rpm is under the above range, grinding efficiency is rapidly reduced and thus productivity is excessively lowered. It is preferable that the horizontal rpm be about 1/3 of the vertical rpm.

[0023] However, the objects of the present invention are not achieved merely by adjusting the rpm of the grinding drum. Even when the grinding operation is performed by the grinding drum which has the protrusions 11 of the same height and rotates at low speed, thermal deformation occurs. The reason is as follows. That is, in order to obtain the bristle having a tapered portion of a desired length, the grinding drum having the protrusions 11 of 3mm or more, preferably, 5mm or more, must be used. However, if such a grinding drum is used, frictional heat is unavoidably accumulated in a space between the protrusions 11, and heat dissipating ability is poor.

[0024] According to the present invention, the rpm of the grinding drum is reduced, and several grinding drums are connected to each other in parallel so that the grinding operation is performed in sequence. There must be 15 or more, preferably, 20 or more grinding drums connected to each other in parallel. If the toothbrush which is to be ground stays in each grinding drum for a predetermined period of time and then moves to the next grinding drum, it is momentarily

cooled by air when the toothbrush is moved, thus preventing thermal deformation. That is, even though frictional heat is generated by the grinding operation, a cooling operation is continuously performed when the bristle moves, so that a thermally stable state is maintained between the temperature of the grinding drums and the temperature of the protrusions 11.

[0025] In order to prevent the thermal deformation of the bristle and simultaneously maximize production efficiency, it is desirable to use 15 to 30 grinding drums. If the number of the grinding drums is less than 15, the bristle is thermally deformed in the grinding operation and production efficiency is poor. If the number exceeds the above range, although a higher deformation preventing effect is not expected, the cost of the machines is increased.

[0026] The height adjustment of the protrusions 11 is a factor which is important to control heat. The protrusions 11 function to increase the length of the tapered portion, and are selected from the range of 1.5 to 7.0mm. Among the grinding drums which participate in the continuous grinding operation, the protrusions 11 of the grinding drums which perform the initial stage of the grinding operation preferably range from 5 to 7mm. Thereby, a tapered portion of a desired length is realized.

[0027] However, as the height of the protrusions 11 increases, the area subject to friction increases. Thus, a lot of frictional heat is generated in the grinding operation, and in addition, a larger amount of frictional heat is accumulated in the space between the protrusions 11. Therefore, it is necessary to gradually reduce the height of the protrusions 11 after the tapered portion of a desired length has been formed.

[0028] Preferably, the protrusions 11 of the grinding drums that participate in the middle stage of the grinding operation, have the height of 3 to 5mm, and the protrusions 11 of the grinding drums that participate in the late stage of the grinding operation, have the height of 1.5 to 3.0mm.

[0029] If the height of the protrusions 11 formed on the grinding drums is sequentially decreased as such, the tapered portion of a desired length is achieved, and in addition, the frictional heat generated by friction is considerably reduced. Further, the generated frictional heat is easily dissipated to the outside, thus effectively preventing the bristle from being thermally deformed.

[0030] Further, as the height of the protrusions 11 is sequentially decreased, the end of the bristle is in continuous contact with the bottom denoted by "P" in Fig. 2 and located between the protrusions 11 of each grinding drum. Thereby, the bristle is highly ground until the thickness of its end is 0.02mm or less.

[0031] The meaning of "the sequential decrease in the height of the protrusions 11" includes the complete sequential arrangement from high protrusions 11 to low protrusions as in the embodiment of the present invention, and also includes the arrangement wherein many high protrusions 11 are placed in a section where the grinding operation starts and many low protrusions 11 are placed in a section where the grinding operation is finished even if the heights of protrusions located in a section do not sequentially vary.

[0032] It is desirable that an interval between the protrusions 11 be about 1 to 5mm. Further, assuming that each protrusion 11 has a cylindrical shape, the protrusion preferably has a diameter of about 1 to 3mm. The protrusion 11 may have a cylindrical shape as in Fig. 2 or may have a conical shape as in Fig. 3.

[0033] Further, if the grain size of grinding stone coating each protrusion 11 is adjusted, a higher quality needle-shaped bristle is achieved. That is, if the grinding drums participating in the initial stage of the grinding operation are coated with grinding stone of 200 to 300 mesh, the grinding drums participating in the middle stage of the grinding operation are coated with grinding stone of 300 to 700 mesh, and the grinding drums participating in the late stage of the grinding operation are coated with grinding stone of 700 to 1000 mesh, a coarse surface formed in the grinding operation becomes very smooth, so that a needle-shaped bristle which has the same high quality as a bristle manufactured by chemical treatment is realized.

[0034] Further, if necessary, each grinding drum may reciprocate in a direction perpendicular to the direction the toothbrush moves in during the grinding operation. The reciprocating motion of the grinding drum can evenly distribute frictional heat generated by friction throughout the grinding drum, and can prolong the life-span of the grinding drum. The distance of proper reciprocating motion is 5 to 10cm.

[Advantageous Effects]

[0035] The present invention provides a highly tapered needle-shaped bristle in which the length of a tapered portion thereof is 5mm or more and the thickness of an end thereof is 0.02mm or less even without undergoing a chemical immersion process, in addition to preventing thermal deformation from occurring during a tapering process using a mechanical method. Further, no chemicals are used, so that the working environment is considerably improved, and the cost of a product is lowered. Furthermore, the scraping of bristles and dust generated during a grinding operation are collected and are recycled as the handle of a toothbrush or the like, so that this method is environment-friendly, and can prevent the loss of resources.

[Description of Drawings]**[0036]**

Fig. 1 is a perspective view showing a grinding drum used in the present invention;
 Fig. 2 is a partially enlarged view showing the bristle of a toothbrush which is ground between protrusions; and
 Fig. 3 is a partially enlarged view showing conical protrusions.

* Description of reference characters of important parts

[0037]

10 :	grinding drum	11 :	protrusion
20 :	rotating shaft	30 :	rotor
P :	bottom between protrusions		

[Best Mode]

The embodiments of the present invention are as follows.

[0039] An interval between protrusions 11 of a grinding drum used in the following embodiments is 2mm for all of the embodiments.

(First Embodiment)

[0040] Protrusions 11 having the heights of 7.0, 6.6, 6.2, 5.8, 5.4, 5.0, 4.6, 4.2, 3.8, 3.4, 3.0, 2.6, 2.2, 1.8, and 1.5mm are formed, and 15 grinding drums rotating vertically and horizontally are arranged in sequence from left to right. Next, an ordinary bristle of a toothbrush which is not tapered undergoes a grinding operation starting from the left grinding drum. The grinding time of each grinding drum is 2.5 seconds, and the vertical rotating speed of the grinding drums are as follows: the vertical rotating speed of the first, second, and third grinding drums is 300 rpm, the vertical rotating speed of the fourth, fifth, and sixth grinding drums is 485 rpm, the vertical rotating speed of the seventh, eighth, and ninth grinding drums is 490 rpm, the vertical rotating speed of the tenth, eleventh, and twelfth grinding drums is 495 rpm, and the vertical rotating speed of the thirteenth, fourteenth, and fifteenth grinding drums is 450 rpm. The horizontal rotating speed is set to be 1/3 of the vertical rotating speed. In order to increase grinding efficiency, each grinding drum is constructed to reciprocate by the distance of 5cm in a direction perpendicular to the direction in which the toothbrush moves.

[0041] The protrusions 11 of the first to fifth grinding drums are coated with grinding stone of 200 mesh, those of the sixth to eighth grinding drums are coated with grinding stone of 350 mesh, those of the ninth to eleventh grinding drums are coated with grinding stone of 550 mesh, and those of the twelfth to fifteenth grinding drums are coated with grinding stone of 850 mesh.

[0042] The length of the tapered portion of the bristle processed in this way is 6mm, and the thickness of the end thereof is 0.03mm.

(Second Embodiment)

[0043] Protrusions 11 having the heights of 7.0, 6.7, 6.4, 6.1, 5.8, 5.5, 5.2, 4.9, 4.6, 4.3, 4.0, 3.7, 3.4, 3.1, 2.8, 2.5, 2.2, 1.9, 1.8, 1.6, and 1.5mm are formed, and 21 grinding drums rotating vertically and horizontally are arranged in sequence from left to right. Next, an ordinary bristle of a toothbrush which is not tapered undergoes a grinding operation starting from the left grinding drum. The grinding time of each grinding drum is 2.5 seconds, and the vertical rotating speed of the grinding drums are as follows: the vertical rotating speed of the first, second, and third grinding drums is 250 rpm, the vertical rotating speed of the fourth, fifth, and sixth grinding drums is 470 rpm, the vertical rotating speed of the seventh, eighth, and ninth grinding drums is 475 rpm, the vertical rotating speed of the tenth, eleventh, twelfth, thirteenth, fourteenth, and fifteenth grinding drums is 480 rpm, the vertical rotating speed of the sixteenth, seventeenth, and eighteenth grinding drums is 460 rpm, and the vertical rotating speed of the nineteenth, twentieth, and twenty-first grinding drums is 450 rpm. The horizontal rotating speed is set to be 1/3 of the vertical rotating speed. The reciprocating motion of each grinding drum is the same as that of the first embodiment.

[0044] The protrusions 11 of the first to fifth grinding drums are coated with grinding stone of 200 mesh, those of the sixth to eighth grinding drums are coated with grinding stone of 350 mesh, those of the ninth to eleventh grinding drums

are coated with grinding stone of 550 mesh, those of the twelfth to sixteenth grinding drums are coated with grinding stone of 850 mesh, and those of the seventeenth to twenty-first grinding drums are coated with grinding stone of 1000 mesh.

[0045] The length of the tapered portion of the bristle processed in this way is 7mm, and the thickness of the end thereof is 0.02mm or less (0.01 to 0.02mm).

(Third Embodiment)

[0046] Protrusions 11 having the height of 7mm are installed on the first to fourth grinding drums, protrusions 11 having the height of 5mm are installed on the fifth to eighth grinding drums, protrusions 11 having the height of 3mm are installed on the ninth to twelfth grinding drums, and protrusions 11 having the height of 1.5mm are installed on the thirteenth to fifteenth grinding drums. The remaining construction remains the same as the first embodiment.

[0047] The length of the tapered portion of the bristle processed in this way is 6mm, and the thickness of the end thereof is 0.02mm.

(First Comparative Example)

[0048] As in the first embodiment, a bristle is ground using 15 grinding drums. However, according to the first comparative example, the protrusions 11 having the same height of 5mm are used. The grinding time of each grinding drum is 2.5 seconds, and the rotating speed of the grinding drums and the meshes of the grinding stone for coating are set to be the same as the first embodiment. When the grinding operation is performed under the above-mentioned conditions, the length of the tapered portion of the obtained bristle is 4mm, and the thickness of the end thereof is 0.04mm. Because of frictional heat, the bristle is deformed. That is, an end of the bristle is bent.

(Second Comparative Example)

[0049] The second comparative example is performed under the same condition as the first embodiment except that the vertical rotating speed is increased to 1,000 rpm and the horizontal rotating speed is increased to 330 rpm. The bristle processed according to the second comparative example has the same tapered length and the same end thickness as the bristle processed according to the first embodiment, but is thermally deformed.

(Third Comparative Example)

[0050] Protrusions 11 formed on each grinding drum have the same height of 6mm, and the grinding method is performed as in the third embodiment. That is, the position of each grinding drum is adjusted such that each of the first to fourth grinding drums is in contact with a portion from an end of a bristle to 6mm, each of the fourth to eighth grinding drums is in contact with a portion from an end of a bristle to 5mm, each of the eighth to twelfth grinding drums is in contact with a portion from an end of a bristle to 3mm, and each of the thirteenth to fifteenth grinding drums is in contact with a portion from an end of a bristle to 1.5mm. The remaining operation is performed as in the first embodiment.

[0051] The tapered length of the obtained bristle is similar to that of the third embodiment. However, some thermal deformation is observed, and the thickness of an end is 0.05mm. As a result, the result of grinding is defective.

Claims

1. A method of tapering a bristle of a toothbrush using grinding drums which have protrusions with height of 1.5 mm to 7.0mm and rotate in vertical and horizontal directions, wherein the grinding drums are connected to each other in parallel and are arranged such that the height of the protrusions formed on each of the grinding drums is sequentially decreased, and a toothbrush having a non-tapered ordinary bristle passes through the grinding drums sequentially, thus continuously grinding the bristle.
2. The method according to claim 1, wherein each of the grinding drums has a vertical rotating speed of 200 rpm to 500 rpm.
3. The method according to claim 2, wherein each of the grinding drums has a vertical rotating speed of 250 rpm to 480 rpm.
4. The method according to claim 1, wherein a number of the arranged grinding drums is 15 to 30.

EP 2 353 433 A2

5. The method according to claim 1, wherein each of the grinding drums reciprocates by a distance of 5 cm to 10cm in a direction perpendicular to a direction of movement of the toothbrush.
6. The method according to claim 1, wherein each of the grinding drums is positioned such that an end of the bristle of the toothbrush is in contact with a bottom between the protrusions.

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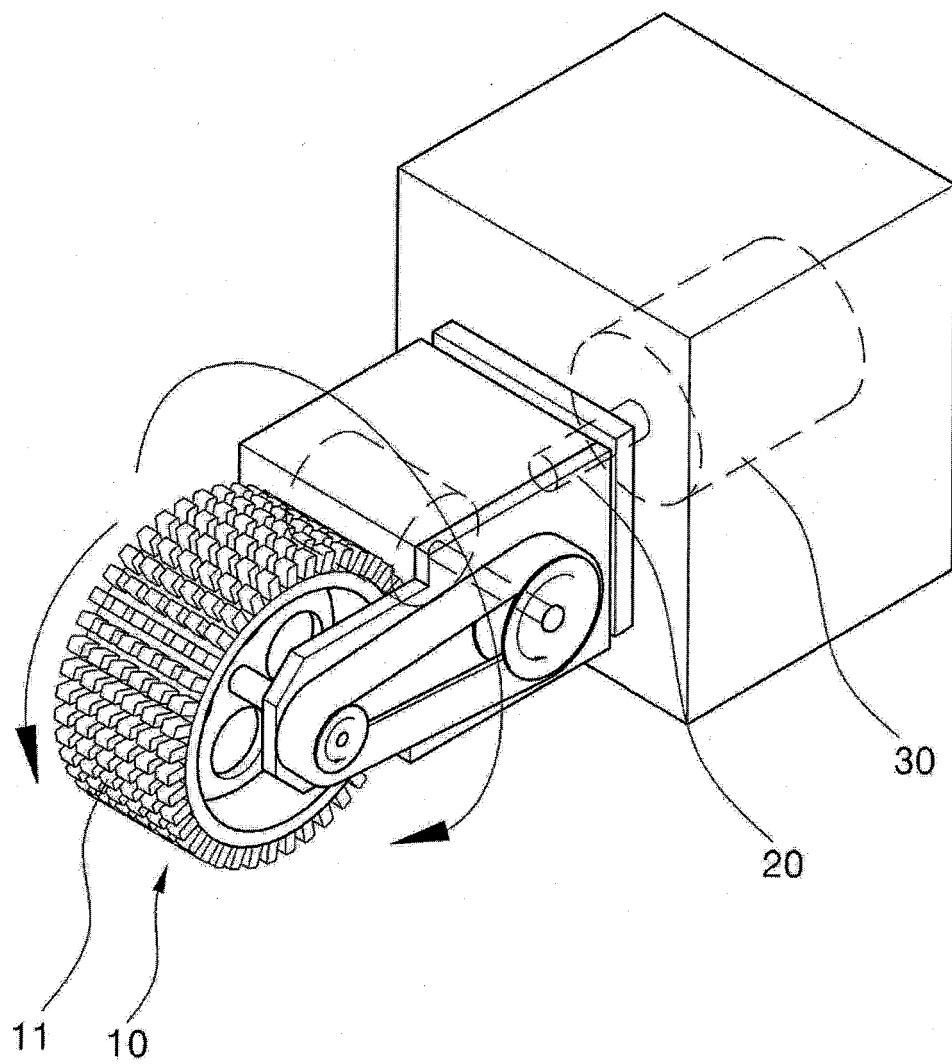
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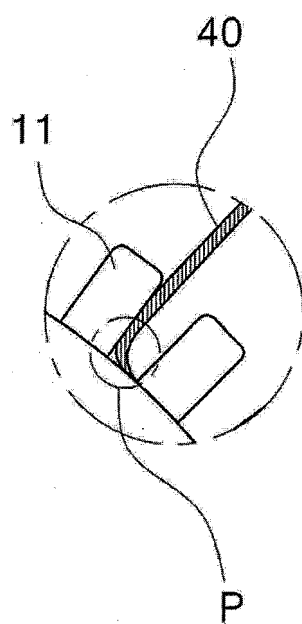
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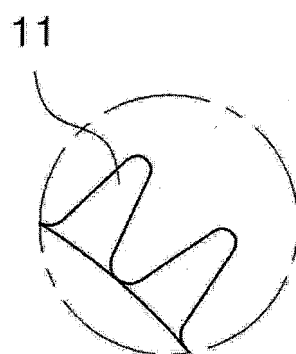


(Fig. 1)

[Fig. 2]



[Fig. 3]



REFERENCES CITED IN THE DESCRIPTION

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