

SPECIFICATION

Hair brush

5 The present invention relates to an improvement in or relating to a hair brush.

One of the fundamental functions of a hair brush is to massage the scalp. In such massaging, however, the scalp is liable to be injured by the sharp ends of the bristles. For this reason, the idea of rounding the ends of the brush bristles has been proposed.

However, when the ends of the bristles are rounded, there is brought about the disadvantage that the bristles do not reach the scalp sufficiently and a sufficient brushing of the hair becomes impossible. If the bristle density is decreased in order to improve the brushing effect, a satisfactory hair-grooming effect cannot be expected.

According to this invention a hair brush comprises a brush body having bristles of at least two different lengths projecting therefrom, at least the longer or longest bristles having enlarged substantially spherical outer ends, where (A) the bristles have a diameter of from 0.45 to 0.70 mm, (B) the bristles have a length of from 15 to 30 mm, (C) the bristles are arranged in the form of discrete bundles of bristles each containing both longer and shorter bristles, and the number of bristles in each bundle is from 2 to 6 bristles, (D) the number of bristles per unit area is from 8 to 30 bristles/cm², and (E) at least one-half of the bristles have enlarged spherical ends the diameter of which is from 1.2 to 2.5 times larger than the diameter of the remainder of such bristles.

The invention will now be described in more detail by way of example and with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a hair brush.

Figure 2 is an enlarged view of a fragment of the hair brush of the present invention.

Figures 3 and 4 are front views showing embodiments of bristles used in the hair brush of the present invention.

Figures 5-11 are graphs showing the effects of the present invention.

45 The hair brush shown comprises bundles or tufts of bristles the lower ends of which are embedded in a hair brush body 2 of any conventional shape. The bristles in each tuft are comprised of longer bristles 1A and shorter bristles 1B. The longer bristles 1A project upwardly from the brush body 2 substantially for equal distances so that their outer ends lie substantially in a first plane which extends substantially parallel to the upper surface of the brush body 2. The shorter bristles 1B likewise project upwardly from the brush body 2 for substantially equal distances, but they are shorter than the bristles 1A so that their outer ends are below the outer ends of the long bristles 1A. Each tuft contains both longer bristles 1A and shorter bristles 1B, preferably in approximately equal numbers. Both types of bristles are substantially uniformly distributed in each tuft so that each longer bristle 1A is located adjacent to shorter bristles 1B, and vice versa. The bristles are made of filaments of synthetic resin. The outer ends of at least the longer bristles 1A are enlarged and

rounded so as to form substantially spherical enlargements 3, the diameters of which are larger than the nominal diameters of the filaments. The shape of the outer ends of the shorter bristles 1B is not critical, but it is preferred that the outer ends be smooth and rounded and they can have enlarged ends as shown, like the enlargements 3 on the longer bristles 1A.

The outer ends of the longer bristles 1A can contact the scalp during brushing of the hair even if the brush has the high bristle density necessary for obtaining a good hair-grooming effect. Further, since the ends of the long bristles 1A which contact the scalp are substantially spherical, a sufficient massaging action is possible with minimum risk of injury to the scalp.

Furthermore, the hair brush according to this invention has the following characteristics:

(A) The bristles have a nominal diameter of from 0.45 to 0.70 mm, wherein "nominal diameter" means the "as-extruded" diameter of the bristle prior to forming the enlargement.

(B) the bristles have a length of from 15 to 30 mm, wherein "length" means the distance the bristles project upwardly above the brush body 2. It has been found that a bristle length of less than 15 mm is too short to obtain a sufficient brushing effect and, on the other hand, a brush having a bristle length of more than 30 mm is disadvantageously difficult to use, because the top of the bristle (working point for massage) is too far from the base of the brush (dynamic point).

(C) the bristles are embedded in the brush body in the form of tufts, each tuft containing 2 to 6 bristles.

(D) the total number of bristles per unit area of the brushing surface is from 8 to 30 bristles/cm², and

(E) at least one-half of the bristles have enlarged spherical ends the diameters of which are from 1.2 to 2.5 times larger than the nominal diameter of the bristles.

The extent of hair damage caused by brushing is influenced greatly by the force imposed on the hair during the brushing. The general relationship between the degree of damage and the brushing strength is as shown in *Figure 5*. The brushing strength differs according to the structure of the brush, as is shown in *Figure 6-8*. The degree of flexing of the bristles is measured by the angle of inclination of the bristles when a load is imposed on the bristle ends. It is thus understood that the requirements for preventing damage to hair are as follows:

1. The bristle density (number of bristles per unit area) should not be excessively high.
2. The planting number (number of bristles per bunch or tuft) should not be excessively high, and
3. The flexibility of the bristles should be high.

On the other hand, it has been found by sensory evaluation based on feel during use of the brush that the planting number of bristles should be two to six per bunch or tuft. Also, there is an optimum range of the degree of flexibility as shown in *Figures 9 to 11*, where the feel of the brush in use is plotted against the number of bristles per tuft, the degree of flexing

of the bristles, and the bristle density, respectively.

If the bristle material and the cross-sectional shape of the bristles are fixed, the flexibility of the bristles depends only on their length and thickness. It has been found that within the range of bristle lengths stated above in requirement (B), an acceptable flexibility in that range is attained when the bristle diameter is in the range limited as set forth above in requirement (A), i.e., 0.45 to 0.70 mm. When the bristle dimensions are within these ranges, a hair brush having good feel in use can be obtained.

Even though it may be possible to obtain bristles possessing acceptable flexibility if the bristle thickness is outside the range of requirement (A) or the bristle length is outside the range of requirement (B), the brush in such a case is difficult to use because the overall size of the bristles will be unsuitable e.g. 1 mm in thickness and 40 to 50 mm in length. Further, in such a case, there cannot be obtained a hair brush which possesses the required properties with respect to preventing injury to the scalp, while providing an adequate massage effect and comfortable feeling during use. When the planting number is outside the range set forth above in requirement (C), in other words, if the bristles are not planted in a bunch containing 2 to 6 bristles, the following defects are observed:

If individual bristles are planted separately from each other, the feel of the brush during use is bad and, on the other hand, if the bristles are planted in the form of a bunch comprising more than 6 bristles, they damage the hair unfavorably. Particularly, when the bunch comprises more than 6 bristles, the disadvantages will be serious, namely, hair is pulled from the scalp during brushing, and the hair is damaged by forming split ends or is weakened by being deformed beyond its elastic limit, and may therefore become broken. This is due to the fact that when the hair passes through the root portions of a bunch of bristles, a high friction force is generated on the hair when a large number of bristles is planted in a bunch. If the bristle density is not within the range as stated above in requirement (D), i.e., with less than 8 bristles/cm², the brushing effect *per se* becomes insufficient and, on the other hand, when it is more than 30 bristles/cm², damage of the hair becomes serious. The optimum bristle density is 12-20 bristles/cm². If the diameter of the enlarged spherical ends of the longer bristles 1A is not within the range as specified above in requirement (E), i.e. when the diameter is more than 2.5 times larger than the nominal bristle diameter, it is difficult for the end of the bristle to reach the scalp and, on the other hand, when the diameter of the enlarged spherical end is less than 1.2 times larger than the nominal bristle diameter, the distribution of stress becomes insufficient, thereby the scalp is rubbed by the bristle end and is likely to be injured, even if the stress is reduced by maintaining the bristle flexibility within the optimum range. In other words, a desirable scalp stimulation cannot be effected unless both a reduction in stress caused by flexing of the bristles and a distribution of the stress over a larger area by using the enlarged spherical bristle ends are provided.

For preventing the scalp from being injured, a

sufficient effect can be obtained when at least one-half of the bristles have enlarged spherical ends, but it is preferred that all the bristles have spherical ends.

As the material for making the bristles according to the present invention, nylon is suitable but other synthetic resin such as polypropylene and polyethylene terephthalate can also be used. Although the flexibility of the bristles varies, depending on the specific material that is used, an excellent hair brush can be obtained when the above requirements (A) to (E) are satisfied.

As the lengths of the bristles, each bundle or tuft has bristles of at least two different lengths, in which the difference between the bristle length of the two types is 1 to 10 mm, more preferably 2 to 5 mm, in each bundle. Particularly when the bristle density is 16 - 30/cm², the above difference in length is important, because it is difficult for the bristle ends to reach the scalp if the spherical ends are too close to each other. With this structure, the ends of the longer bristles readily contact the scalp and improve the massaging effect. The spherical ends of the longer bristles 1A first contact the scalp and if a stronger force is imposed, the spherical ends of the shorter bristles then contact the scalp. The shorter bristles have a smaller flexing degree and give a more rigid feel. Therefore, the feel of the brush can be altered by controlling the force imposed thereon.

Usually, two bristles are provided by bending a filament into a U-shape (Figures 3 and 4). The bent portions of such U-shaped filaments are embedded in the brush body 2. There can be used U-shaped filaments of different lengths, bent in the middle, to provide the longer bristles 1A and the shorter bristles 1B, respectively, as shown in Figure 3, or there can be used U-shaped filaments of the same length with the bent portions non-central to provide a longer bristle 1A and a shorter bristle 1B on each filament, as shown in Figure 4.

CLAIMS

1. A hair brush comprising a brush body having bristles of at least two different lengths projecting therefrom, at least the longer or longest bristles having enlarged substantially spherical outer ends, wherein (A) the bristles have a diameter of from 0.45 to 0.70 mm, (B) the bristles have a length of from 15 to 30 mm, (C) the bristles are arranged in the form of discrete bundles of bristles each containing both longer and shorter bristles, and the number of bristles in each bundle is from 2 to 6 bristles, (D) the number of bristles per unit area is from 8 to 30 bristles/cm², and (E) at least one-half of the bristles have enlarged spherical ends the diameter of which is from 1.2 to 2.5 times larger than the diameter of the remainder of such bristles.

2. A hair brush according to claim 1 consisting of bristles of two different lengths wherein the longer bristles are from 1 to 10 mm longer than the shorter bristles.

3. A hair brush according to claim 2, wherein the number of bristles per unit area is from 12 to 20 bristles/cm², and the longer bristles are from 2 to 5



of the bristles, and the bristle density, respectively.

If the bristle material and the cross-sectional shape of the bristles are fixed, the flexibility of the bristles depends only on their length and thickness. It has

5 been found that within the range of bristle lengths stated above in requirement (B), an acceptable flexibility in that range is attained when the bristle diameter is in the range limited as set forth above in requirement (A), i.e., 0.45 to 0.70 mm. When the
10 bristle dimensions are within these ranges, a hair brush having good feel in use can be obtained.

Even though it may be possible to obtain bristles possessing acceptable flexibility if the bristle thickness is outside the range of requirement (A) or the
15 bristle length is outside the range of requirement (B), the brush in such a case is difficult to use because the overall size of the bristles will be unsuitable e.g. 1 mm in thickness and 40 to 50 mm in length. Further, in such a case, there cannot be obtained a hair brush
20 which possesses the required properties with respect to preventing injury to the scalp, while providing an adequate massage effect and comfortable feeling during use. When the planting number is outside the range set forth above in requirement (C),
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35 from the scalp during brushing, and the hair is damaged by forming split ends or is weakened by being deformed beyond its elastic limit, and may therefore become broken. This is due to the fact that when the hair passes through the root portions of a
40 bunch of bristles, a high friction force is generated on the hair when a large number of bristles is planted in a bunch. If the bristle density is not within the range as stated above in requirement (D), i.e., with less than 8 bristles/cm², the brushing effect *per se* becomes insufficient and, on the other hand,
45 when it is more than 30 bristles/cm², damage of the hair becomes serious. The optimum bristle density is 12-20 bristles/cm². If the diameter of the enlarged spherical ends of the longer bristles 1A is not within
50 the range as specified above in requirement (E), i.e. when the diameter is more than 2.5 times larger than the nominal bristle diameter, it is difficult for the end of the bristle to reach the scalp and, on the other hand, when the diameter of the enlarged spherical
55 end is less than 1.2 times larger than the nominal bristle diameter, the distribution of stress becomes insufficient, thereby the scalp is rubbed by the bristle end and is likely to be injured, even if the stress is reduced by maintaining the bristle flexibility within the optimum range. In other words, a desirable scalp stimulation cannot be effected unless both a reduction in stress caused by flexing of the bristles and a distribution of the stress over a larger area by using the enlarged spherical bristle ends are provided.
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sufficient effect can be obtained when at least one-half of the bristles have enlarged spherical ends, but it is preferred that all the bristles have spherical ends.

70 As the material for making the bristles according to the present invention, nylon is suitable but other synthetic resin such as polypropylene and polyethylene terephthalate can also be used. Although the flexibility of the bristles varies, depending on the specific material that is used, an excellent hair brush can be obtained when the above requirements (A) to (E) are satisfied.

As the lengths of the bristles, each bundle or tuft has bristles of at least two different lengths, in which
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85 stronger force is imposed, the spherical ends of the shorter bristles then contact the scalp. The shorter bristles have a smaller flexing degree and give a more rigid feel. Therefore, the feel of the brush can be altered by controlling the force imposed thereon.
90 Usually, two bristles are provided by bending a filament into a U-shape (Figures 3 and 4). The bent portions of such U-shaped filaments are embedded in the brush body 2. There can be used U-shaped filaments of different lengths, bent in the middle, to provide the longer bristles 1A and the shorter
95 bristles 1B, respectively, as shown in Figure 3, or there can be used U-shaped filaments of the same length with the bent portions non-central to provide a longer bristle 1A and a shorter bristle 1B on each
100 filament, as shown in Figure 4.

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CLAIMS

1. A hair brush comprising a brush body having
110 bristles of at least two different lengths projecting therefrom, at least the longer or longest bristles having enlarged substantially spherical outer ends, wherein (A) the bristles have a diameter of from 0.45 to 0.70 mm, (B) the bristles have a length of from 15 to 30 mm, (C) the bristles are arranged in the form of discrete bundles of bristles each containing both longer and shorter bristles, and the number of
115 bristles in each bundle is from 2 to 6 bristles, (D) the number of bristles per unit area is from 8 to 30 bristles/cm², and (E) at least one-half of the bristles have enlarged spherical ends the diameter of which is from 1.2 to 2.5 times larger than the diameter of the remainder of such bristles.

2. A hair brush according to claim 1 consisting of
125 bristles of two different lengths wherein the longer bristles are from 1 to 10 mm longer than the shorter bristles.

3. A hair brush according to claim 2, wherein the number of bristles per unit area is from 12 to 20
130 bristles/cm², and the longer bristles are from 2 to 5



mm longer than the shorter bristles.

4. A hair brush according to claim 1, in which the bristles are formed by the legs of U-shaped filaments the bent portions of which are embedded in the brush body, wherein the lengths of the two bristles formed by each filament are substantially equal, the longer bristles being provided by U-shaped filaments of a longer length.
5. A hair brush according to claim 1, in which the bristles are formed by the legs of U-shaped filaments the bent portions of which are embedded in the brush body, wherein the lengths of the two bristles formed by each filament are different.
6. A hair brush substantially as herein described, with reference to the accompanying drawings.

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