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— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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(54) Title: DETANGLING HAIR BRUSH

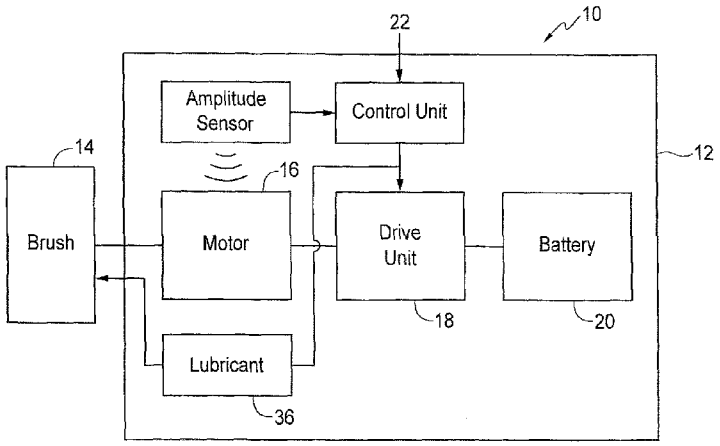

FIG. 1

(57) Abstract: The appliance includes a housing and an attached brushhead which oscillates at a selected frequency and amplitude by a motor and drive system. A system recognizes a hair tangle as the brushhead is drawn through the hair by a decrease in amplitude of movement of the brushhead, A control system changes the operation of the brushhead in response to the recognizing system in such a manner as to untangle the hair.

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DETANGLING HAIR BRUSH

Description

Technical Field

[0001] This invention relates generally to hair brushes, including power hair brushes, and more particularly concerns such a power hair brush which is adapted for detangling hair.

Background

[0002] Hair tangles can result from many factors or causes. They occur when hair strands do not lie neatly against each other, but rather are mixed up. Hair tangles can occur, for example, from a lack of consistent combing, by piling hair when it is being washed, from the effects of wind and from sleeping without a hairnet/protector. The extent and condition of hair tangles can also vary depending upon the texture and length of the hair, as well as the fullness of the hair. Whatever the cause and extent, however, it is important to detangle the hair to maintain its overall health and appearance. Detangling, however, can be a time-consuming and in some cases painful experience. Detangling hair products can help, but are typically not the complete or best solution for the many types of tangles.

[0003] Accordingly, an appliance which is adapted to conveniently and reliably detangle hair is desirable.

Summary

[0004] Accordingly, a brush appliance for detangling hair comprises: an appliance body; a brushhead mounted to the appliance body; a motor for oscillating the brushhead at a selected frequency and amplitude; a system for recognizing a hair tangle as the brushhead is moved through the hair; and a control system for changing the driving of the brushhead and/or providing a detangling solution to the brushhead so as to detangle hair as the brushhead encounters the tangle.

[0005] Further, a method for detangling hair using a power hair brush comprises the steps of: Oscillating a brushhead portion of the hair brush at a selected frequency and amplitude; recognizing a hair tangle as the brushhead is moved through the hair; and changing driving of the

brushhead and/or providing a detangling solution to the brushhead so as to detangle the hair as the brushhead encounters the tangle.

Brief Description of the Drawings

[0006] Figure 1 is a structural block diagram of a detangling hair brush in accordance with the present invention.

[0007] Figure 2 is a functional diagram of the operation of the appliance of Figure 1.

[0008] Figure 3A is a simplified diagram showing the position of the appliance prior to detangling.

[0009] Figure 3B is a simplified diagram showing the position of the appliance during detangling.

[00010] Figure 3C is a simplified diagram showing the detangled hair.

Best Mode for Carrying Out the Invention

[00011] Figure 1 shows the appliance in schematic block form at 10. The appliance includes a body 12 with a removable hair brush 14. The hair brush itself is conventional and can have a variety of bristle arrangements and configurations. In the embodiment shown, the brushhead is driven in an oscillating manner by a motor 16 which is controlled by a drive unit 18. The motor and drive unit can take a variety arrangements. One such arrangement, among many, is shown in US Patent No. 7,157,816. In one embodiment, the drive unit is typically powered by a rechargeable battery 20, which could be by solar charging. Generally, the appliance includes one or more power sources. Non-limiting examples of power sources include one or more button cells, chemical battery cells, a fuel cell, secondary cells, lithium ion cells, micro-electric patches, nickel metal hydride cells, silver-zinc cells, capacitors, super-capacitors, thin film secondary cells, ultra-capacitors, zinc-air cells, or the like. Further non-limiting examples of power sources include one or more generators (e.g., electrical generators, thermo energy-to-electrical energy generators, mechanical-energy-to-electrical energy generators, micro-generators, nano-generators, or the like) such as, for example, thermoelectric generators, piezoelectric generators, electromechanical generators, or the like. In an embodiment, the power

source includes one or more micro-batteries, printed micro-batteries, thin film batteries, fuel cells (e.g., biofuel cells, chemical fuel cells etc.), or the like, including replaceable alkaline cells.

[00012] The appliance is controlled by an on/off switch 22. In the embodiment shown, the brushhead moves at a frequency in the range of 70-115 Hz, although this can be varied. The preferred amplitude is 10-19° peak-to-peak, with a duty cycle of approximately 40%, although these values again can be varied. Prior to use of the appliance for detangling hair, the load applied to the motor by combing untangled hair is determined. This produces a learned baseline for the detangling operation. This load value, in terms of frequency and amplitude, is stored in the control unit processor.

[00013] Following this learning step, the detangling brush is now ready for use. The brush identifies a tangle as the brushes move through the hair by measuring a change in the load condition of the motor, relative to the baseline load. This change in load will typically modify the action/behavior of the system. The measurement can be done by various arrangements. One preferred arrangement to measure the change in amplitude of the armature portion or end effecter of the motor, as shown, at 24 in Figure 1, such as by an optical encoder. The optical encoder 24 can typically be internal of the housing of the appliance, although it can also be external. It measures amplitude by determining whether an infrared LED light or lights are obscured or not obscured, depending on the specific arrangement used. Typically, to ensure that an actual tangle is being encountered, the change in amplitude must be verified for a particular number of cycles of operation, usually more than one, typically up to five, although a one cycle change can be used.

[00014] While the optical encoder is one preferred arrangement, other motor amplitude sensors can be used, including a Hall effect sensor for determining the change of amplitude of the motor armature. Other possible arrangements include a magnetic switch which is actuated as the armature approaches the position of the switch. A physical contact switch could also be used.

[00015] In addition to armature amplitude change, other arrangements could be used to determine load change due to a tangle, including measurement of back EMF of the motor to determine amplitude or speed change. Still further, an audio pickup member could be used to

measure the difference in audio tone produced by the appliance, depending on the particular loading condition. All of the above measurement devices/techniques are directed toward determining a change in motor operation or sound when the brushhead encounters a loading condition which indicates a tangle. It is important that a tangle be accurately identified, relative to a baseline (non-tangled) hair combing condition.

[00016] The information from amplitude sensor 24 is applied to the control unit (processor) 28 which is programmed to recognize a tangle, for instance when the motor armature amplitude decreases a preselected amount. This amount can vary, but should be sufficient to reliably indicate a tangle. For example, this could be a decrease in amplitude of 10-20%.

[00017] When a tangle has been recognized, the processor will then adjust the drive unit 18 to address the tangle. This can be done in various ways. One method would be to change the motor frequency. This change of frequency will continue until the hair is detangled, or alternatively the change in frequency could be for a burst of 5-10 cycles, sometimes referred to as a slew of frequency, either an increase or decrease. The change in frequency would be to correspond to the new system load and increase amplitude. For example the change in frequency could be a value in the range between $\pm$ 50 Hz from the original frequency. Alternatively, the adjustment could be made by a change in duty cycle, in the range of a $\pm$ 25% change in the original duty cycle. Still further, detangling lubricant could be released from a dispenser 36 to the brushhead 14. The change in duty cycle or frequency can be combined and also used in combination with the release of lubricant.

[00018] A functional flow chart is shown in Figure 2, based on a change in motor load and subsequent change in motor action/behavior. In operation, the appliance is turned on, as shown in block 34, and is used to comb hair in a conventional manner, as shown in block 36A. The normal motor load is determined and stored during combing of untangled hair, block 37. Following this initial step, the appliance is used to comb the hair and if the appliance does not encounter a tangle, block 38, combing is continued, until at 36B it is completed. At that point, the appliance is turned off at 40. If a tangle in encountered, at 41, the brush behavior will change, usually the brush amplitude will decrease, due to the increased load, as shown in block 42. A sensor, such as an optical encoder, will sense the decrease in amplitude as indicated in

block 44. The processor will adjust the drive wave form in some manner such as frequency, voltage, pulse width, etc., as shown at block 46, and/or may in addition cause the appliance to release a detangling fluid through the brush, as shown at block 48.

[00019] Figure 3A shows appliance 52, with an oscillating brushhead 54, approaching a tangle 56 in the hair 5. Figure 3B shows the appliance operating on the tangle, by recognizing a change of amplitude, for example, as the tangle is encountered and then changing the action of the motor and hence the brushhead. The tangle is released, as shown at block 58 and in Figure 3C. When the tangle is released, the brush amplitude will change (typically increase) due to a change (decrease) in load, as shown at block 60. This change in amplitude will be detected, as represented by block 62. The processor will recognize the change in amplitude and will reset the motor drive to the original wave form, as shown in block 64. Further, any release of lubricant will be terminated.

[00020] At this point, the user will continue to comb the hair as shown at block 36B. When the combing is done, the appliance is turned off, as shown at block 40.

[00021] The flow chart of Figure 2 represents the function steps each time a tangle is encountered by the appliance.

[00022] Although a preferred embodiment of the invention has been disclosed for purposes of illustration, it should be understood that various changes, modifications and substitutions may be incorporated in the embodiment without departing from the spirit from the invention, which is defined by the claims which follow.

[00023] What is claimed is:

Claims

1. A brush appliance for detangling hair, comprising:

an appliance body;

a brushhead mounted to the appliance body;

a motor for oscillating the brushhead at a selected frequency and amplitude;

a system for recognizing a hair tangle as the brushhead is moved through the hair; and

a control system for changing the driving of the brushhead and/or providing a detangling solution to the brushhead so as to detangle the hair as the brushhead encounters the tangle.

2. The appliance of claim 1, wherein the recognizing system includes a system for recognizing a change in amplitude of brushhead movement sufficient to indicate a tangle.

3. The appliance of claim 2, wherein the change in amplitude is a decrease in amplitude.

4. The appliance of claim 2, wherein the amplitude recognizing system is an optical encoder.

5. The appliance of claim 2, wherein the amplitude recognizing system is a Hall effect assembly.

6. The appliance of claim 2, wherein the amplitude recognizing system is a magnetic switch.

7. The appliance of claim 1, wherein the recognizing system includes a sensor assembly for recognizing back EMF in the motor sufficient to indicate a tangle.

8. The appliance of claim 1, wherein the recognizing system includes a sensor for determining a change in audio from the appliance.

9. The appliance of claim 1, wherein the recognizing system uses one to five cycles of brushhead operation to determine that a tangle has been encountered.

10. The appliance of claim 1, wherein the brushhead in operation oscillates at a frequency between 70-115 Hz, with an amplitude between 10-19°.

11. The appliance of claim 1, wherein the change in driving of the brushhead is a change in frequency of brushhead oscillation.

12. The appliance of claim 1, wherein the brushhead operation is returned to the selected frequency and amplitude following detangling of the hair.

13. The appliance of claim 1, wherein the change in driving of the brushhead is a change in duty cycle of the motor.

14. The appliance of claim 1, including a reservoir containing a detangling solution, wherein the detangling solution is applied to the hair through the brushhead.

15. A method for detangling hair using a power hair brush, comprising the steps of:

oscillating a brushhead portion of the hair brush at a selected frequency and amplitude;

recognizing a hair tangle as the brushhead is moved through the hair; and

changing driving of the brushhead and/or providing a detangling solution to the brushhead so as to detangle the hair as the brushhead encounters the tangle.

16. The method of claim 15, wherein the step of recognizing change in amplitude of brushhead movement sufficient to indicate a tangle.

17. The method of claim 15, wherein the step of recognizing includes one to five cycles of brushhead operation to determine that a tangle has been encountered.

18. The method of claim 15, wherein the brushhead in operation oscillates at a frequency between 70-115 Hz, with an amplitude between 10-19°.

19. The method of claim 15, wherein the change in driving the brushhead is a change in frequency of brushhead oscillation.

20. The method of claim 15 wherein the brushhead is returned to the selected frequency and amplitude following detangling of the hair.

21. The method of claim 15, wherein the change in driving of the brushhead is a change in duty cycle of the motor.

22. The method of claim 15, including the step of applying a detangling solution to the hair through the brushhead.

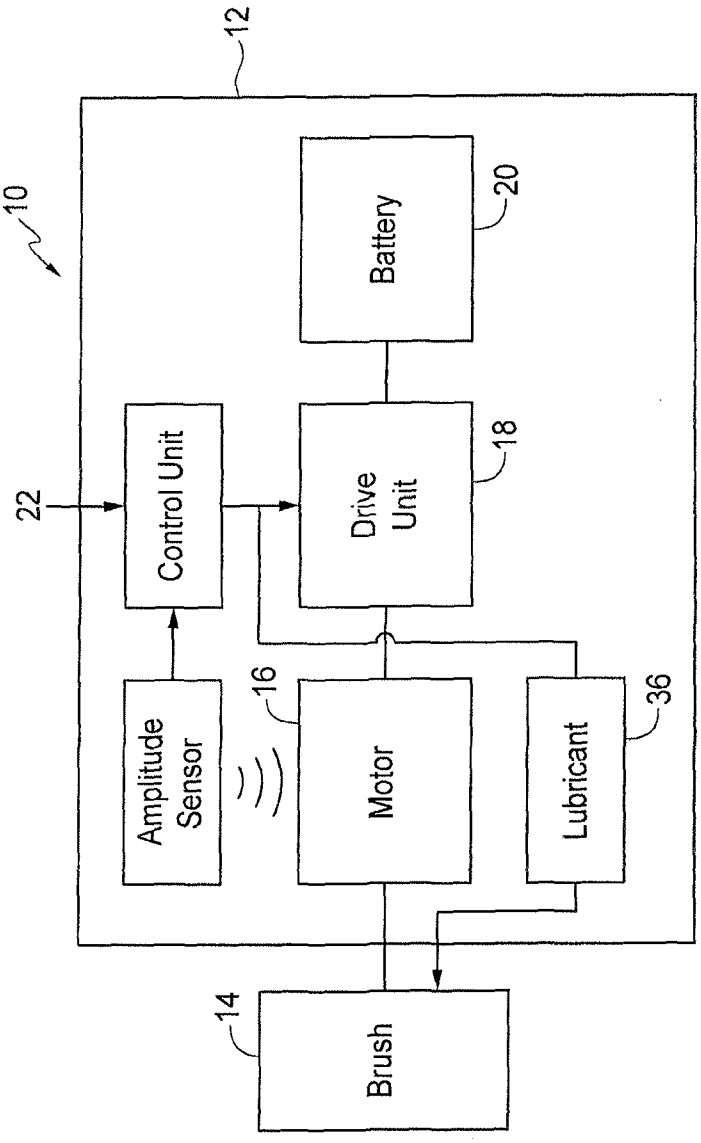
12
10
Battery
20
22
Control Unit
Drive Unit
18
Amplitude Sensor
16
Motor
Lubricant
36
14
Brush

FIG. 1

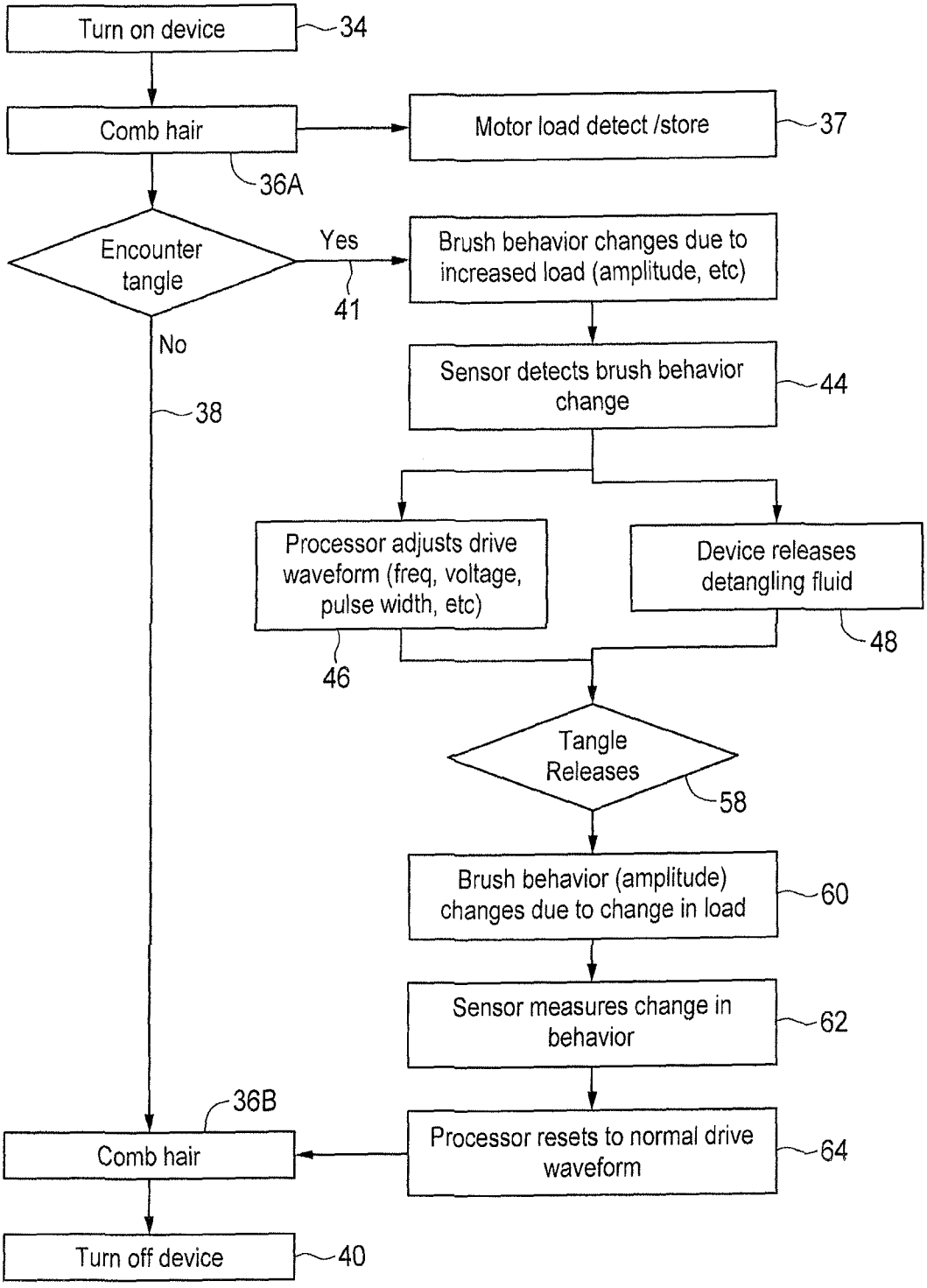
Turn on device
34
Comb hair
Motor load detect /store
37
36A
Encounter tangle
Yes
Brush behavior changes due to increased load (amplitude, etc)
41
No
38
Sensor detects brush behavior change
44
Processor adjusts drive waveform (freq, voltage, pulse width, etc)
Device releases detangling fluid
48
46
Tangle Releases
58
Brush behavior (amplitude) changes due to change in load
60
Sensor measures change in behavior
62
36B
Comb hair
Processor resets to normal drive waveform
64
Turn off device
40

FIG. 2

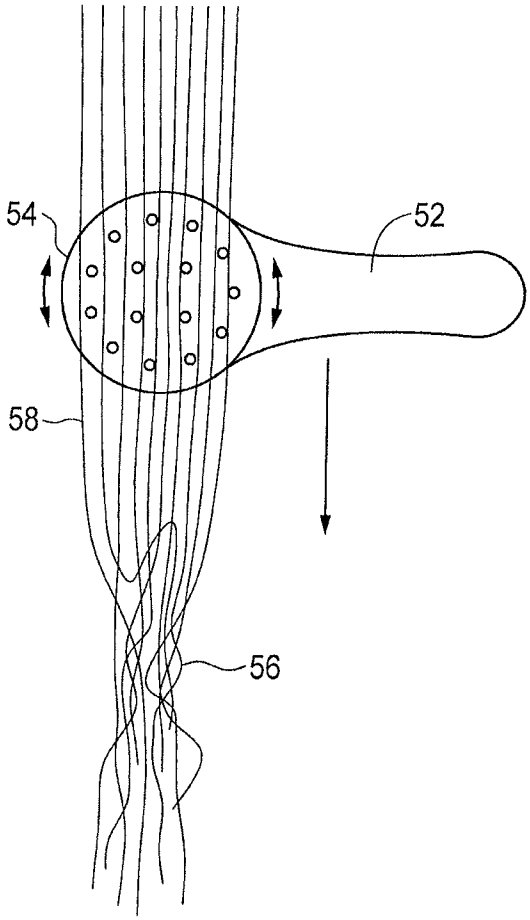

FIG. 3A

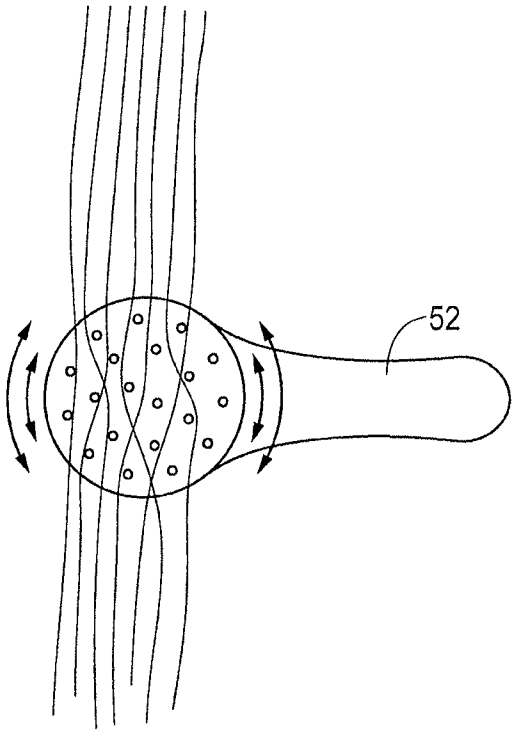

FIG. 3B

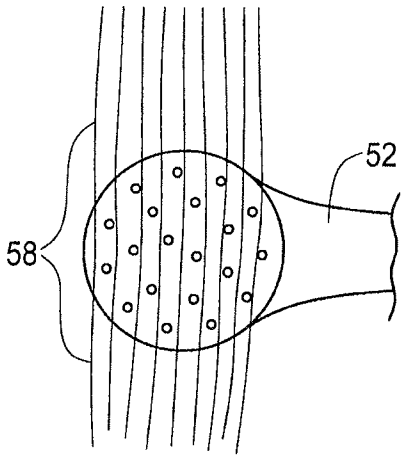

FIG. 3C

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/042211

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A45D 2/00; B26B 19/12; B26B 19/14; H02K 33/00 (2016.01)
CPC - A45D 2/00; B26B 19/12; B26B 19/14; H02K 33/00 (2016.08)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC - A45D 2/00; B26B 19/12; B26B 19/14; H02K 33/00
CPC - A45D 2/00; B26B 19/12; B26B 19/14; H02K 33/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC: 132/120; 132/211; 132/119.100 (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Orbit, Google Patents, Google
Search terms used: detangler, hairbrush, amplitude sensor

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2014/0090661 A1 (MM&R PRODUCTS, INC.) 03 April 2014 (03.04.2014) entire document	1-22
Y	US 2014/0137714 A1 (KRENIK) 22 May 2014 (22.05.2014) entire document	1-22
Y	US 2003/0233861 A1 (WOOLSTON et al) 25 December 2003 (25.12.2003) entire document	2-6, 8, 16
Y	CN 103112019 A (LIAO YAN FU) 22 May 2013 (22.05.2013) entire document	7
Y	US 5,839,451 A (DORBER et al) 24 November 1998 (24.11.1998) entire document	10, 18
Y	US 6,883,199 B1 (LUNDELL et al) 26 April 2005 (26.04.2005) entire document	13, 21
Y	US 2012/0090631 A1 (MESTRE) 19 April 2012 (19.04.2012) entire document	14, 22

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

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
02 September 2016	29 SEP 2016
Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 571-273-8300	Authorized officer Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774