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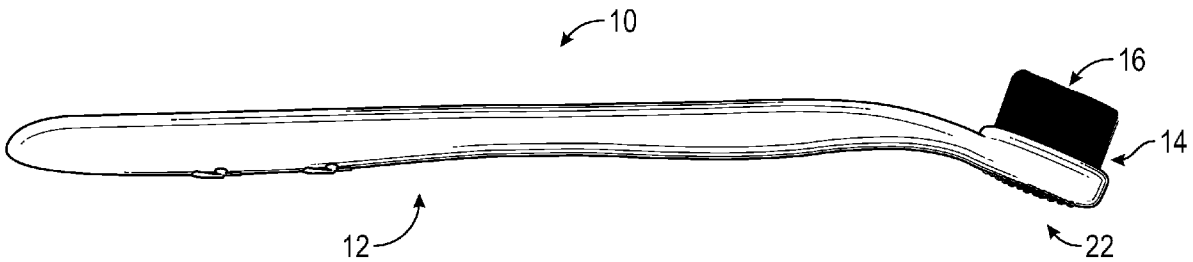

FIG. 1

(57) Abstract: A toothbrush comprising a brush head having a plurality of nano-bristles. In one embodiment, the plurality of nano-bristles each have a length, and a diameter of at least a portion of the length is in a range of 50 microns to 150 microns. In another embodiment, the nano-bristles have a base portion and a top portion, with the base portion of the nano-bristles having a diameter in a range of 400 microns to 500 microns and the top portion of the nano-bristles have a diameter in a range of 50 microns to 150 microns.

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PET TOOTHBRUSH

CROSS-REFERENCE TO RELATED APPLICATIONS

This U.S. non-provisional patent application claims the benefit of the filing date of U.S. provisional patent application serial no. 63/263,164, filed October 28, 2021, the entire disclosure of which is incorporated herein by reference.

FIELD

The present disclosure relates to toothbrushes, and more particularly toothbrushes that comprise nanofibers, to support the oral hygiene of pets.

BACKGROUND

The oral hygiene of pets remains an on-going issue for development. Efforts include the use of non-edible or edible type chews that are designed to provide some level of abrasion to the teeth to remove plaque and improve the health of the gums. Other efforts have simply relied upon the use of human toothbrushes, along with a toothpaste composition that is relatively appealing to the animal. Accordingly, a need remains to improve the oral hygiene of pets via the design and use of a pet toothbrush that is particularly suitable for the dental requirements of an animal, and in particular domestic pets, such as dogs or cats.

SUMMARY

A toothbrush comprising a brush head having a plurality of nano-bristles; wherein the plurality of nano-bristles each have a length, and a diameter of at least a portion of the length is in a range of 50 microns to 150 microns.

In at least one embodiment, the plurality of nano-bristles are each infused or coated with an additive to reduce plaque and/or bacteria.

In at least one embodiment, the additive of each nano-bristle of the plurality of nano-bristles is present at a level of 0.1 % by weight to 10.0 % by weight of each of the nano-bristles of the plurality of nano-bristles, respectively.

In at least one embodiment, the plurality of nano-bristles are each infused or coated with at least one of sodium hexametaphosphate, ascorbic acid, and beta glucan.

In at least one embodiment, the plurality of nano-bristles are each infused or coated with chitosan.

In at least one embodiment, the plurality of nano-bristles are in a range of 5,000 to 15,000 nano-bristles.

In at least one embodiment, the plurality of nano-bristles have a length of less than or equal to 1.5 cm.

In at least one embodiment, the plurality of nano-bristles define an outer perimeter region and an inner region surrounded by the outer perimeter region; and wherein the length of the nano-bristles of the outer perimeter region is shorter than the length than the nano-bristles of the inner region.

In at least one embodiment, the plurality of nano-bristles define an outer perimeter region and an inner region surrounded by the outer perimeter region; and wherein the diameter of at least a portion of the length of the nano-bristles of the outer perimeter region is in a range of 100 microns to 150 microns; and wherein the diameter of at least a portion of the length of the nano-bristles of the inner region is in a range of 50 microns to less than 100 microns.

In at least one embodiment, the nano-bristles of the outer perimeter region form a complete loop around the nano-bristles of the inner region.

In at least one embodiment, the diameter of at least 25% of the length of the plurality of nano-bristles in the range of 50 microns to 150 microns.

In at least one embodiment, the plurality of nano-bristles are colored with a colorant which fades with use of the toothbrush; and wherein the colorant fades with a reduction in an anti-bacterial and/or an anti-fungal treatment provided by the nano-bristles.

In at least one embodiment, the plurality of nano-bristles are formed of a polymeric composition.

In at least one embodiment, the polymeric composition comprises at least one of polyamide, polyethylene, poly(butylene terephthalate), poly(ethylene terephthalate) and polyurethane.

In at least one embodiment, the brush head further comprises an abrasive surface having a plurality of protrusions of a side of the brush head opposite a side having the plurality of nano-bristles.

In at least one embodiment, the toothbrush comprises an elongated handle to hold the toothbrush; and wherein the elongated handle and the brush head are formed as a single-piece.

In at least one embodiment, the toothbrush is in the form of a finger-cap brush configured to be disposed on a finger of a user.

In at least one embodiment, the finger-cap brush comprises a finger cavity to configured to receive the finger of the user therein to hold the toothbrush.

In at least one embodiment, the plurality of nano-bristles extend substantially perpendicular to a longitudinal axis of the finger-cap brush.

A toothbrush comprising a brush head having a plurality of nano-bristles; wherein the nano-bristles have a base portion and a top portion; wherein the base portion of the nano-bristles have a diameter in a range of 400 microns to 500 microns; and wherein the top portion of the nano-bristles have a diameter in a range of 50 microns to 150 microns.

A toothbrush comprising a brush head including a plurality of nano-bristles projecting from the brush head, wherein the nano-bristles have a diameter in the range of 50 microns to 150 microns. Optionally, the nano-bristles are infused or coated with an additive that reduces plaque and/or bacteria.

A toothbrush comprising a brush head including a plurality of nano-bristles projecting from the brush head, wherein the nano-bristles have a base portion and a top portion, having a diameter in the range of 400 microns to 500 microns at the base portion and a diameter of 50 microns to 150 microns at the top portion.

BRIEF DESCRIPTION OF THE DRAWINGS

The detailed description below may be better understood with reference to the accompanying figures which are provided for illustrative purposes and are not to be considered as limiting any aspect of the disclosure.

FIG. 1 is a perspective side view of an embodiment of a pet toothbrush having nano-bristles according to the present disclosure, with the toothbrush comprising an elongated handle;

FIG. 2 is a close-up perspective side view of a head portion of the pet toothbrush of FIG. 1;

FIG. 3 is a side view of another embodiment of a pet toothbrush having nano-bristles according to the present disclosure, with the toothbrush comprising a finger cap brush;

FIG. 4 is another side view of the pet toothbrush of FIG. 3;

FIG. 5 is a side view of an embodiment of an alternative bristle according to the present disclosure;

FIG. 6 is a top end view looking downwardly at nano-bristles of an embodiment of a pet toothbrush according to the present disclosure, illustrating the nano-bristles having different diameters; and

FIG. 7 is a cross-section of the bristles of FIG. 6 taken along line 7-7.

DETAILED DESCRIPTION

It may be appreciated that the present disclosure is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the drawings. The embodiments herein may be capable of other embodiments and of being practiced or of being carried out in various ways. Also, it may be appreciated that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting.

Turning now to the figures, FIG. 1 is a perspective side view of a configuration of a pet toothbrush 10 according to the present disclosure. As can be observed, the pet toothbrush 10 includes an elongated handle portion 12 and a head portion 14 joined to the handle portion (formed as a single piece), with bristles 16 extending from a head portion 14.

In addition, as best shown in FIG. 2, preferably on a side of the head portion 14 opposite a side of the bristles 16, the toothbrush 10 may preferably include an abrasive surface 22. Such abrasive surface 22 preferably comprises a plurality of spaced-apart projections 24 having a height in a range of 0.1 mm to 1.0 mm and a diameter in a range of 0.5 mm to 1.5 mm and spaced apart at a distance of 0.1 mm to 1.0 mm. More preferably, the height may be in a range of 0.4 mm to 0.6 mm, the diameter may be in a range of 0.8 mm to 1.2 mm and the projections may be spaced apart a distance of 0.4 mm to 0.6 mm.

Although FIGS. 1 and 2 show one configuration of the toothbrush 10 according to the present disclosure, it is contemplated that the toothbrush 10 herein may be in the form of a finger-cap brush configured to be disposed on and over a distal end of a finger of a human user. A shown in FIGS. 3 and 4, a consumer/user may insert a distal portion of their index (pointer) finger into a tubular finger cavity 42 of a hollow cup body 40, comprising a tapering tube/tubular wall (similar

to a thimble), to hold the toothbrush 10. The bristles 16 may be attached to a distal end region of an upper/outer head portion 44 of the hollow cup body 40, particularly by being disposed in and extending from an elongated recess 46, which has a longitudinal length which extends substantially parallel (e.g. within 10 degrees of being parallel and inclusive of parallel) with a longitudinal axis L-L of the toothbrush 10. As also show, a length of the bristles 16 extend substantially perpendicular (e.g. within 10 degrees of being perpendicular and inclusive of perpendicular) with a longitudinal axis L-L of the toothbrush 10. The hollow cup body 40, comprising the tapering tube/tubular wall, may have an outer diameter 50 in a range of 15 mm to 35 mm, and an inner (cavity) diameter 52 in a range of 10 mm to 32 mm. The hollow cup body 40 may have a longitudinal length 54 in a range of 20 mm to 75 mm.

For the various embodiments of pet toothbrushes 10 disclosed herein, the bristles 16 herein are preferably nano-bristles. More particularly, the bristles 16 have a diameter of at least a portion of their length, and more particularly the full working length, in the range of 50 microns to 150 microns, and more preferably 50 microns to 100 microns. As shown in FIG. 5, the bristles 16 may also preferably be tapered, meaning that the diameter D_B may begin at 400 microns to 500 microns at their base portion 19 where they are attached to the head 16 and then taper to a reduced diameter D_T at their top portion 21 where they are designed to come in contact with the teeth or gums of the pet. Accordingly, the nano-bristles 16 may therefore have a diameter of 400 microns to 500 microns at their base and then taper to a diameter in the range of 50 microns to 150 microns.

Preferably, the head portion includes 5,000 to 15,000 nano-bristles 16, more preferably 8,000 to 12,000 nano-bristles 16. In one particularly preferred embodiment, the head portion contains 9,500 to 10,500 nano-bristles 16. The nano-bristles 16 may preferably be made from a polymeric material composition, such as nylon (polyamides), polyethylene, poly(butylene terephthalate), poly(ethylene terephthalate), and/or polyurethane.

The nano-bristles 16 are preferably coated or infused with additives that are particularly useful for improving the oral hygiene of the animal and reducing plaque that harbors bacteria. For example, the nano-bristles 16 herein may preferably have a coating or be infused with 0.1 % by weight to 10.0 % by weight of an additive, such as sodium hexametaphosphate, ascorbic acid, or a beta glucan. The beta glucan may be extracted from a natural or genetically modified source, such as yeasts, mushrooms, or saccharomyces cerevisiae. In addition, it is contemplated herein that the nano-bristles 16 may be coated or infused with chitosan, which is reference to the

polysaccharide composed mainly (at least 50% or more) of randomly distributed β-(1→4)-linked D-glucosamine (deacetylated unit) and N-acetyl-D-glucosamine (acetylated unit). It is contemplated that the chitosan will be particularly effective to gram-negative and gram-positive bacteria, as well as activity to fungi.

Additionally, the nano-bristles 16 herein may optionally be colored. For example, when the nano-bristles 16 herein are preferably coated or impregnated with chitosan and a colorant, or sodium hexametaphosphate and a colorant, consumers/users will be alerted as to when the chitosan and/or sodium hexametaphosphate has been fully utilized, as the colorant fades or is completely eliminated follow brushing of a pet's teeth or gums. The consumer/user is then aware that the anti-bacterial and/or anti-fungal treatment provided by the nano-bristles 16 is reduced or no longer present.

Referring now to FIG. 6, such is a top end view looking downwardly at the nano-bristles 16 (of the pet toothbrush head 14 of FIGS. 1- 2 or FIGS. 3-4) illustrating the use of nano-bristles 16 of different diameters. That is, the nano-bristles 16 may include an outer perimeter region 60 having a width of 1.0 to 6.0 mm, that includes nano-bristles 16 having a diameter in the range of 100 microns to 150 microns. The nano-bristles 16 may then preferably include an inner region 62 surrounded by the outer perimeter region 60 having a width of 8.0 to 13.0 mm, that includes nano-bristles 16 having a diameter in the range of 50 microns to less than 100 microns, and more preferably, 70 microns to 90 microns. As shown, the outer perimeter region 60 completely surrounds the inner region 62, i.e. forms a complete 360 degree loop.

The nano-bristles 16 preferably have an exposed working length 18 (which extend/project from the surface 17 of a bristle mounting region 15 of the head 14/44) of 2. 0 cm or less, and more particularly 1.5 cm or less. More preferably, the nano-bristles 16 extend a distance of 0.5 cm to 1.3 cm. In addition, the nano-bristles 16 that are located in outer perimeter region 60 preferably have a height (exposed length 18) that is less than the height (exposed length 18) of the nano-bristles 16 that are located in the inner region 62. For example, the height (exposed length 18) of the nano-bristles 16 located on the outer perimeter region 60 may be in the range of 0.8 cm to 1.1 cm and the height (exposed length 18) of the nano-bristles 16 located in the inner region 62 may be in the range of 1.1 cm to 1.2 cm, with the provision that with respect to such ranges, the height (exposed length 18) of the nano-bristles 16 located on the outer perimeter region 60 of the toothbrush 10 are less than the height (exposed length 18) of the nano-bristles 16 located on the

inner 62 region. For example, as shown in FIG. 7, relatively shorter nano-bristles 16 may be present at region 60 in FIG. 6, which is on the outside of the nano-bristles 14 and relatively longer bristles in the inner region 22. Also, for example, the nano-bristles 16 located in the outer perimeter region 60 may have a height (exposed length 18) which is in a range of 0.1 mm to 0.4 mm, and more preferably 0.1 mm to 0.3 mm, less than the height (exposed length 18) of the nano-bristles 16 located on the inner 62 region.

In certain embodiments, at least 25% of length 18 of the nano-bristles 16 have a diameter in the range of 50 microns to 150 microns, and more preferably 50 microns to 100 microns. In other embodiments, at least 50% of length 18 of the nano-bristles 16 have a diameter in the range of 50 microns to 150 microns, and more preferably 50 microns to 100 microns. In other embodiments, at least 75% of length 18 of the nano-bristles 16 have a diameter in the range of 50 microns to 150 microns, and more preferably 50 microns to 100 microns. In other embodiments, 100% of length 18 of the nano-bristles 16 have a diameter in the range of 50 microns to 150 microns, and more preferably 50 microns to 100 microns.

While particular embodiments of the present invention has been described, it should be understood that various changes, adaptations and modifications can be made therein without departing from the spirit of the invention and the scope of the appended claims. The scope of the invention should, therefore, be determined not with reference to the above description, but instead should be determined with reference to the appended claims along with their full scope of equivalents. Furthermore, it should be understood that the appended claims do not necessarily comprise the broadest scope of the invention which the Applicant is entitled to claim, or the only manner(s) in which the invention may be claimed, or that all recited features are necessary.

Listing of reference characters

10	pet toothbrush
12	handle portion
14	head portion
15	bristle mounting region
17	mounting surface
16	bristles
18	bristle length

	19	base portion
	21	top portion
	22	abrasive surface
	24	protrusions
5	40	cup body
	42	finger cavity
	44	upper/outer head portion
	46	elongated recess
	50	outer diameter
10	52	inner diameter
	54	longitudinal length
	60	outer perimeter region
	62	inner region
	L	longitudinal axis
15	D_B	diameter base
	D_T	diameter top

What is claimed:

1. A toothbrush comprising:

a brush head having a plurality of nano-bristles;

wherein the plurality of nano-bristles each have a length, and a diameter of at least a portion of the length is in a range of 50 microns to 150 microns.

2. The toothbrush of claim 1, wherein:

the plurality of nano-bristles are each infused or coated with an additive to reduce plaque and/or bacteria.

3. The toothbrush of claim 2, wherein:

the additive of each nano-bristle of the plurality of nano-bristles is present at a level of 0.1 % by weight to 10.0 % by weight of each of the nano-bristles of the plurality of nano-bristles, respectively.

4. The toothbrush of claim 1, wherein:

the plurality of nano-bristles are each infused or coated with at least one of sodium hexametaphosphate, ascorbic acid, and beta glucan.

5. The toothbrush of claim 1, wherein:

the plurality of nano-bristles are each infused or coated with chitosan.

6. The toothbrush of claim 1, wherein:

the plurality of nano-bristles are in a range of 5,000 to 15,000 nano-bristles.

7. The toothbrush of claim 1, wherein:

the plurality of nano-bristles have a length of less than or equal to 1.5 cm.

8. The toothbrush of claim 1, wherein:

the plurality of nano-bristles define an outer perimeter region and an inner region surrounded by the outer perimeter region; and

wherein the length of the nano-bristles of the outer perimeter region is shorter than the length than the nano-bristles of the inner region.

9. The toothbrush of claim 1, wherein:

the plurality of nano-bristles define an outer perimeter region and an inner region surrounded by the outer perimeter region; and

wherein the diameter of at least a portion of the length of the nano-bristles of the outer perimeter region is in a range of 100 microns to 150 microns; and

wherein the diameter of at least a portion of the length of the nano-bristles of the inner region is in a range of 50 microns to less than 100 microns.

10. The toothbrush of claim 9, wherein:

the nano-bristles of the outer perimeter region form a complete loop around the nano-bristles of the inner region.

11. The toothbrush of claim 1, wherein:

the diameter of at least 25% of the length of the plurality of nano-bristles in the range of 50 microns to 150 microns.

12. The toothbrush of claim 1, wherein:

the plurality of nano-bristles are colored with a colorant which fades with use of the toothbrush; and

wherein the colorant fades with a reduction in an anti-bacterial and/or an anti-fungal treatment provided by the nano-bristles.

13. The toothbrush of claim 1, wherein:

the plurality of nano-bristles are formed of a polymeric composition.

14. The toothbrush of claim 13, wherein:

the polymeric composition comprises at least one of polyamide, polyethylene, poly(butylene terephthalate), poly(ethylene terephthalate) and polyurethane.

15. The toothbrush of claim 1, wherein:

the brush head further comprises an abrasive surface having a plurality of protrusions of a side of the brush head opposite a side having the plurality of nano-bristles.

16. The toothbrush of claim 1, wherein:

the toothbrush comprises an elongated handle to hold the toothbrush; and

wherein the elongated handle and the brush head are formed as a single-piece.

17. The toothbrush of claim 1, wherein:

the toothbrush is in the form of a finger-cap brush configured to be disposed on a finger of a user.

18. The toothbrush of claim 17, wherein:

the finger-cap brush comprises a finger cavity to configured to receive the finger of the user therein to hold the toothbrush.

19. The toothbrush of claim 18, wherein:

the plurality of nano-bristles extend substantially perpendicular to a longitudinal axis of the finger-cap brush.

20. A toothbrush comprising:

a brush head having a plurality of nano-bristles;

wherein the nano-bristles have a base portion and a top portion;

wherein the base portion of the nano-bristles have a diameter in a range of 400 microns to 500 microns; and

wherein the top portion of the nano-bristles have a diameter in a range of 50 microns to 150 microns.

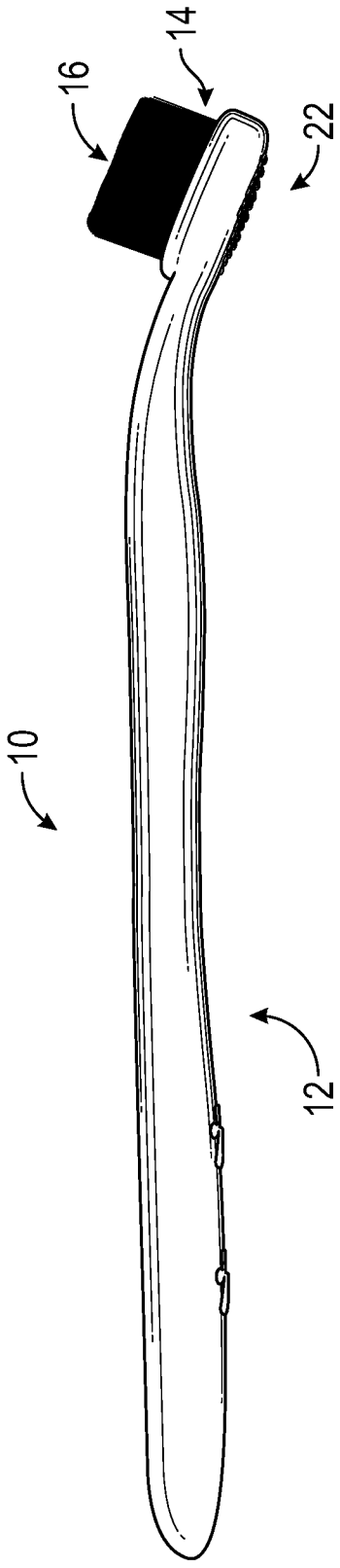

FIG. 1

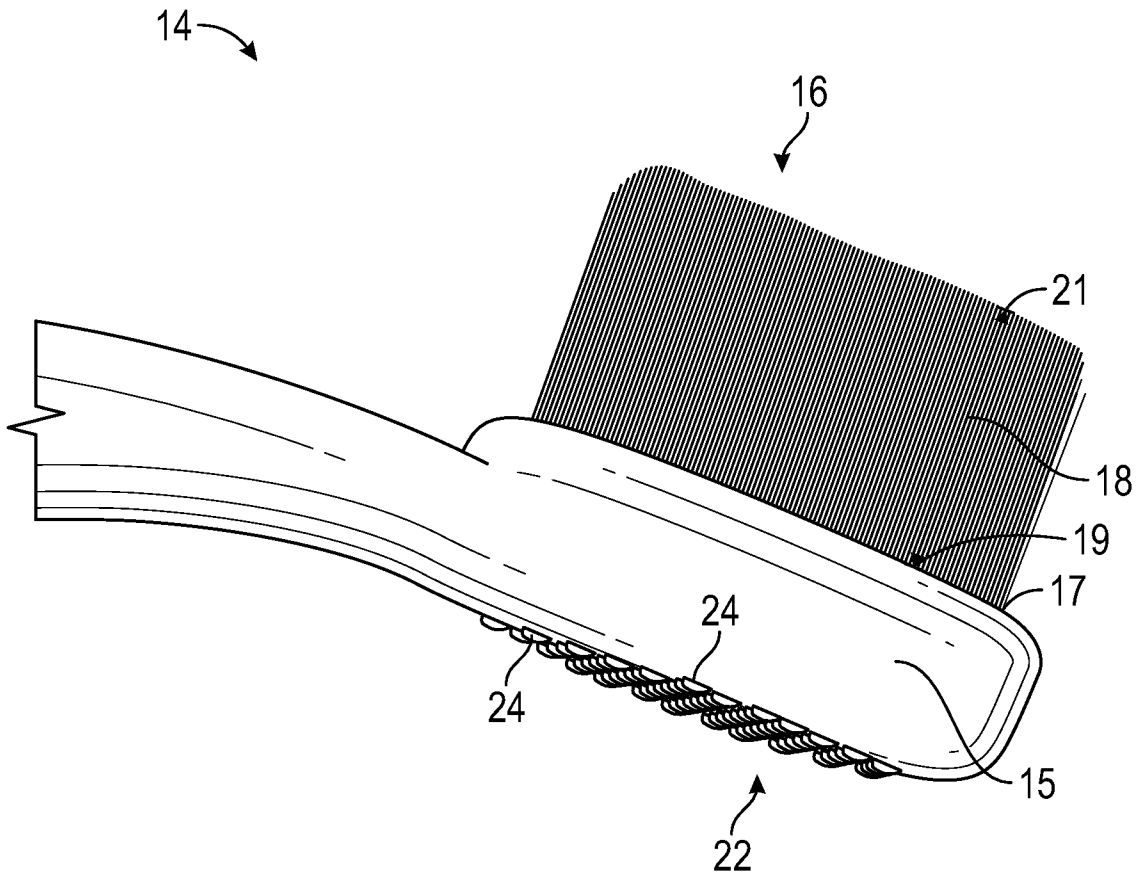

FIG. 2

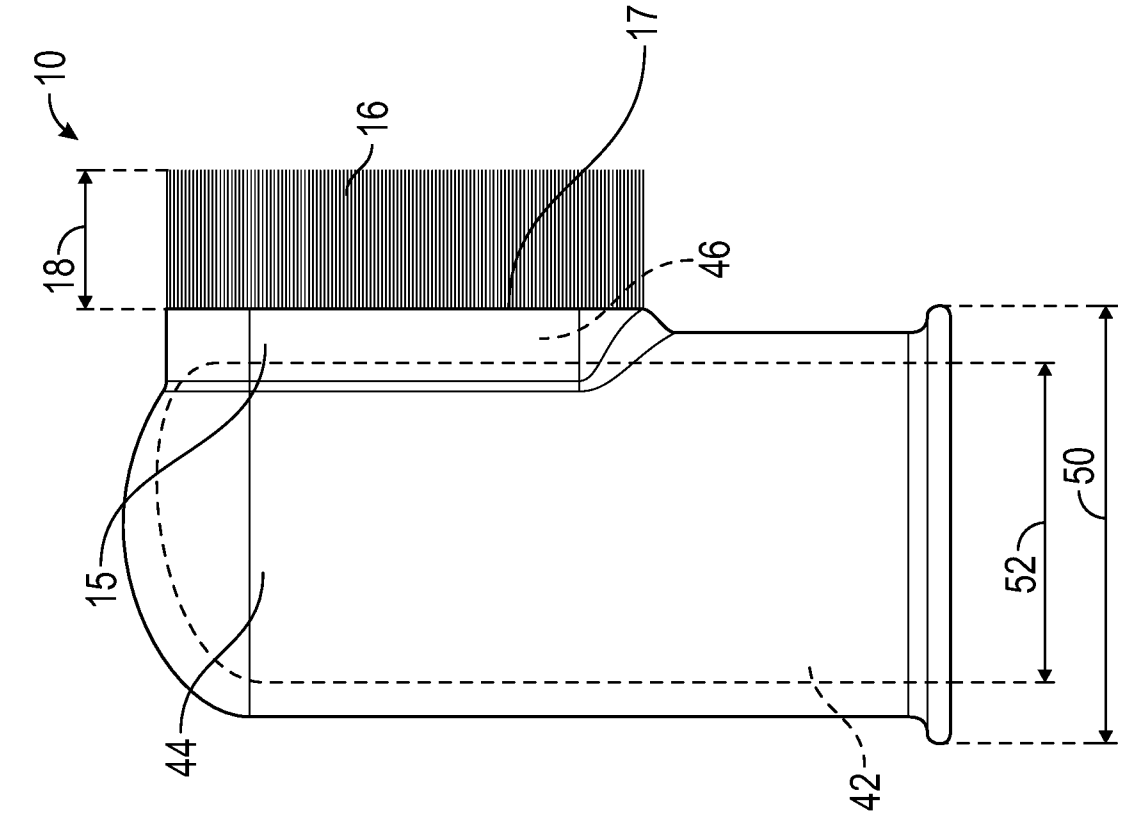

FIG. 4

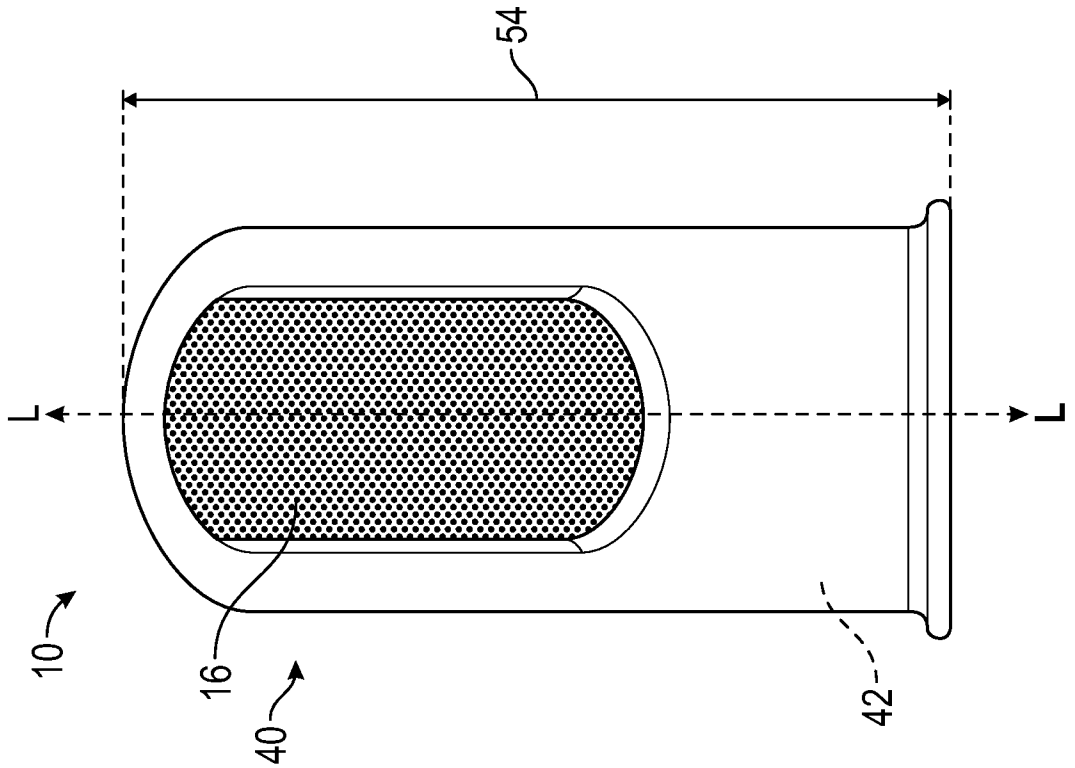

FIG. 3

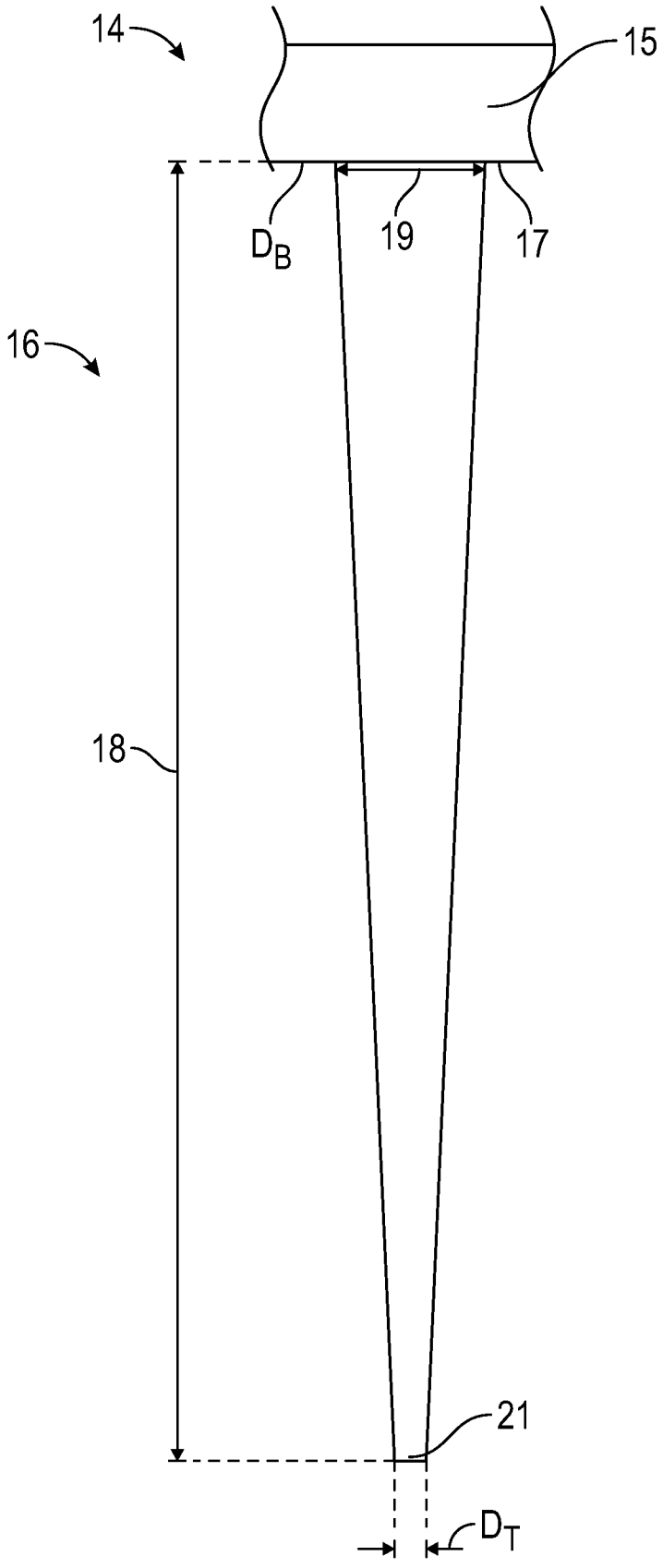

FIG. 5

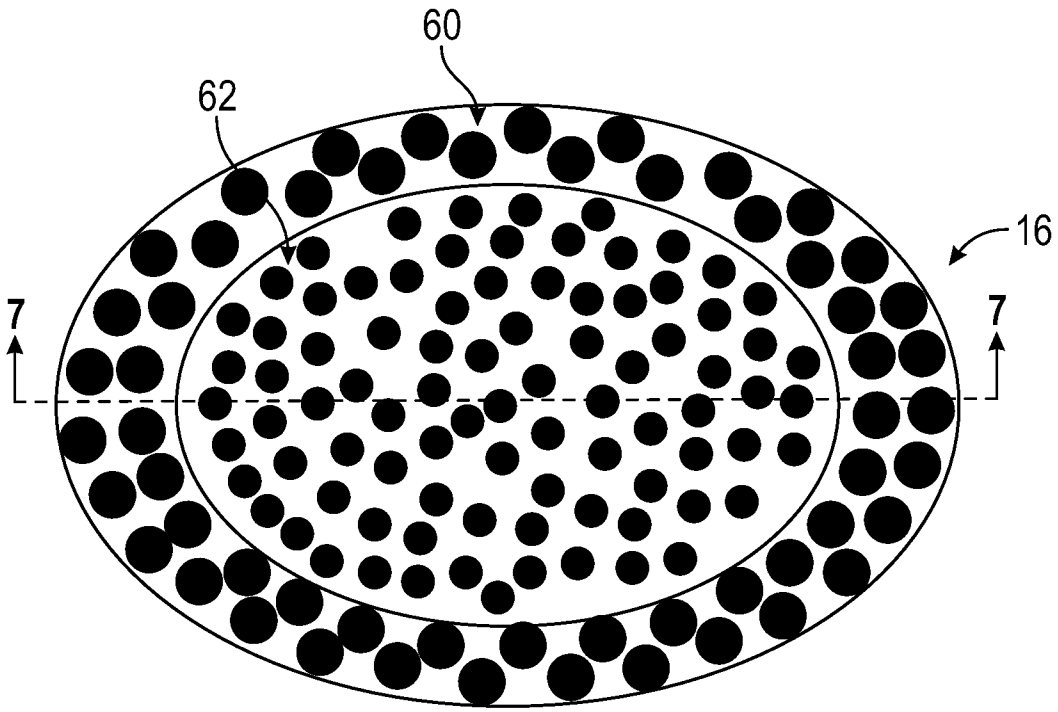

FIG. 6

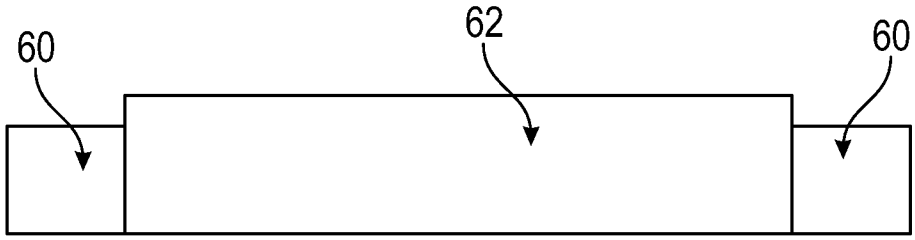

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2022/078788

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - INV. - A46B 5/04; A46B 9/04 (2022.01)
ADD.

CPC - INV. - A46B 5/04; A46B 15/001; A46D 1/006; A46B 9/04 (2022.08)

ADD. - A46D 1/0276; B29L 2031/425; A46B 2200/1066 (2022.08)

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)
See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
See Search History document

Electronic database consulted during the international search (name of database and, where practicable, search terms used)
See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	JP 2018-102726 A (LION SHOJI KK) 05 July 2018 (05.07.2018) see machine translation	1, 2, 7, 11, 13, 14, 17-19 --- 8-10
X --- Y	TOYAKU Nano Toothbrush. Amazon. 11 September 2021 (11.09.2021). [Retrieved on 28.12.2022]. Retrieved from: <URL: https://www.amazon.co.jp/-/en/TOYAKU-Toothbrush-Adults-Caries-Prevention/dp/B09G13TXZD >. entire document	1, 6, 11, 13-16 --- 2-5, 12
X	CN 112741412 A (SHANGHAI TOUTI INTERNET TECHNOLOGY CO. LTD.) 04 May 2021 (04.05.2021) see machine translation	20
Y	US 6,199,242 B1 (MASTERMAN et al) 13 March 2001 (13.03.2001) entire document	2-4, 12
Y	WO 2018/233317 A1 (QINGDAO RONGSHANGTIANXIA NETWORK CO. LTD) 27 December 2018 (27.12.2018) see machine translation	5
Y	US 5,419,001 A (WAN) 30 May 1995 (30.05.1995) entire document	8
Y	US 5,467,495 A (BOLAND et al) 21 November 1995 (21.11.1995) entire document	9, 10
A	CN 212260800 U (YANGZHOU JINXIA PLASTIC CO. LTD.) 01 January 2021 (01.01.2021) see machine translation	1-20

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

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