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Jacob et al.(10) **Pub. No.: US 2013/0000663 A1**(43) **Pub. Date: Jan. 3, 2013**(54) **BRANCHED APPLICATOR TINES AND AN
APPLICATOR BRUSH HEAD
INCORPORATING BRANCHED TINES**(52) **U.S. Cl. 132/218; 15/207.2**(76) Inventors: **Christophe Jacob**, Saint Denis le
Thibault (FR); **Herve F. Bouix**, New
York, NY (US)(57) **ABSTRACT**(21) Appl. No.: **13/174,007**(22) Filed: **Jun. 30, 2011****Publication Classification**(51) **Int. Cl.**
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A46D 1/00 (2006.01)

A cosmetic applicator brush head has a plurality of molded tines, each with a main shaft and a first and a second branch extending from the shaft. The first branch extends at a point between the base of the shaft and the free end of the shaft. The second branch extends from the shaft at a point between the base of the shaft and the first branch. The first and second branches extend in a radial direction from the shaft at an angle of 5° to 90° relative to a longitudinal axis of the shaft.

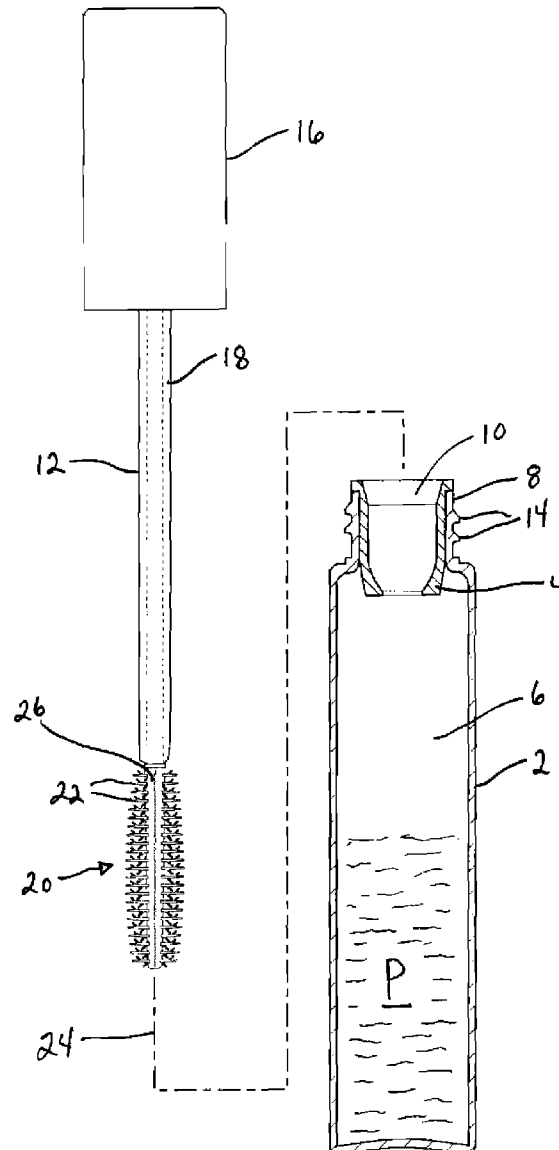


FIG. 1

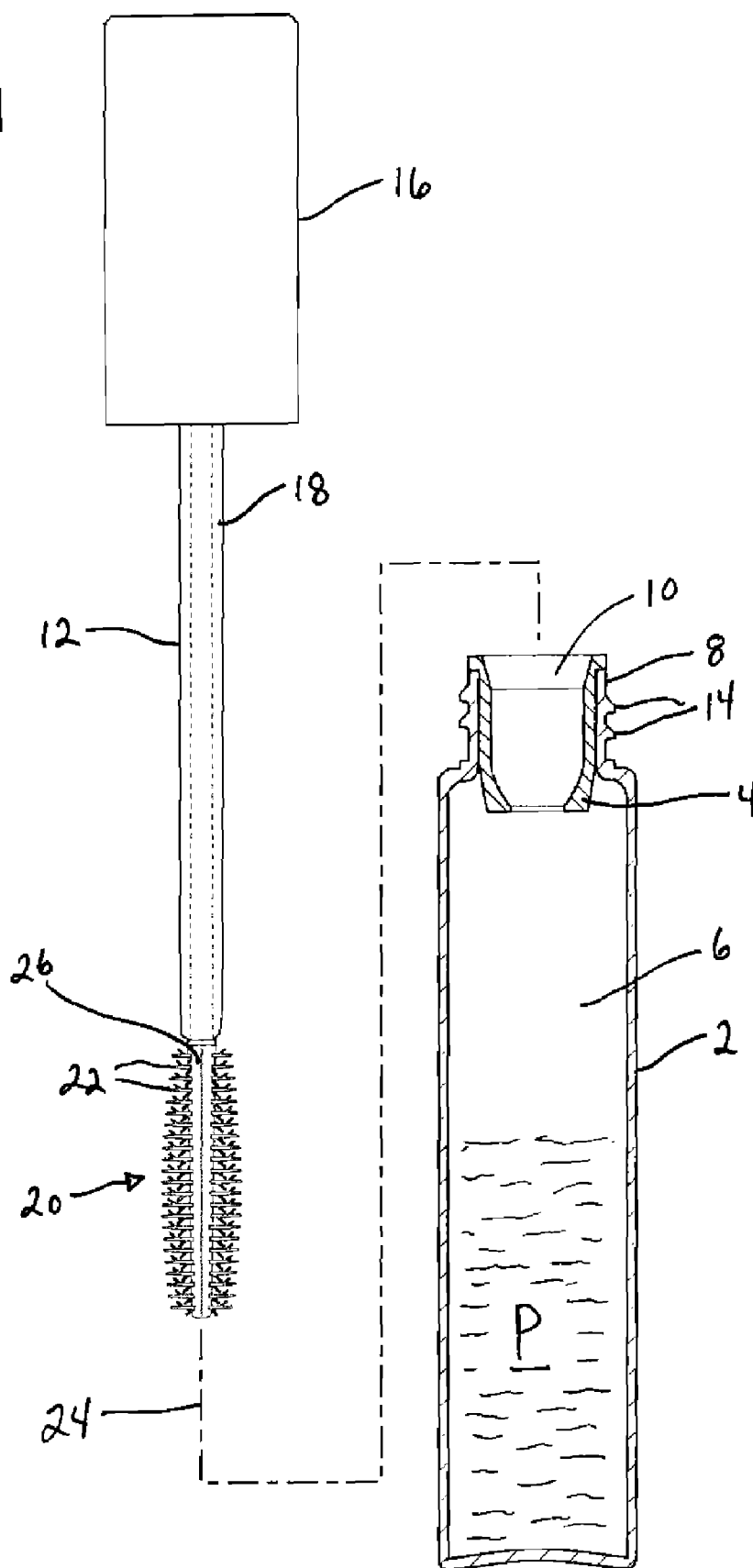


FIG. 2

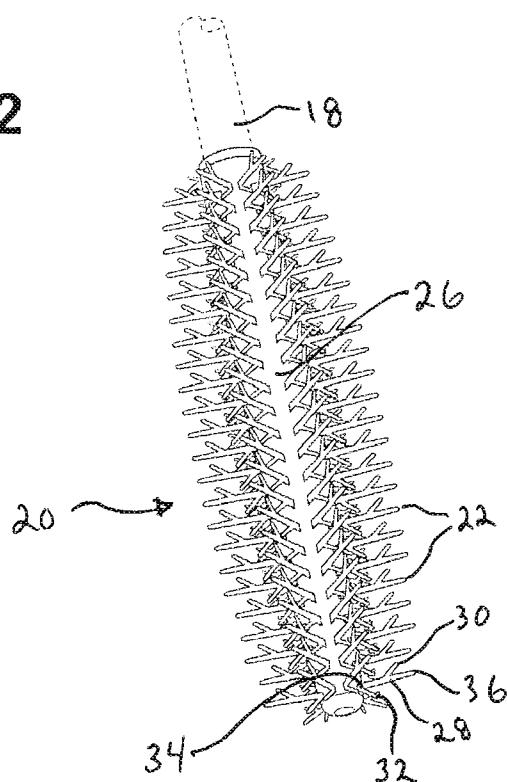
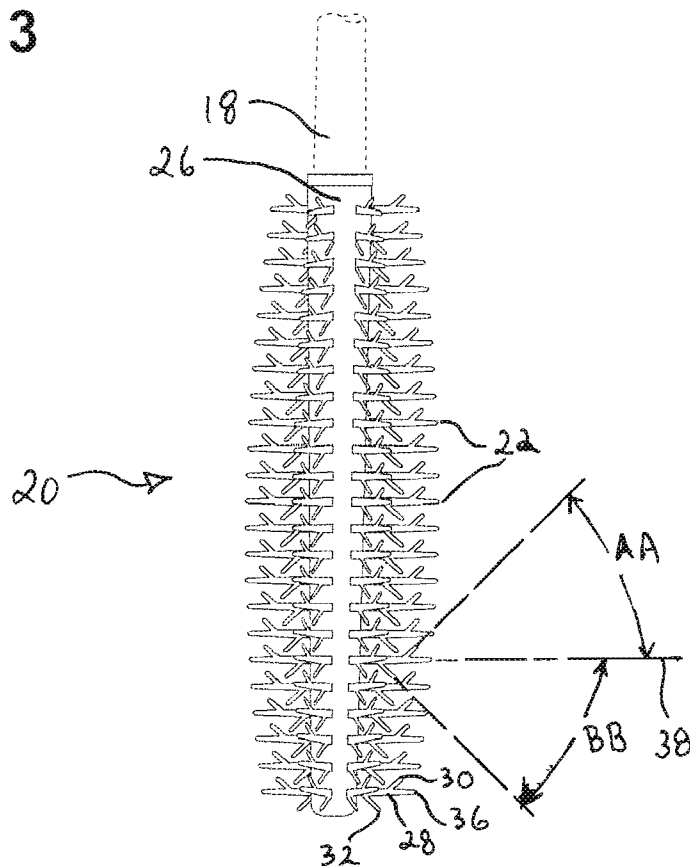
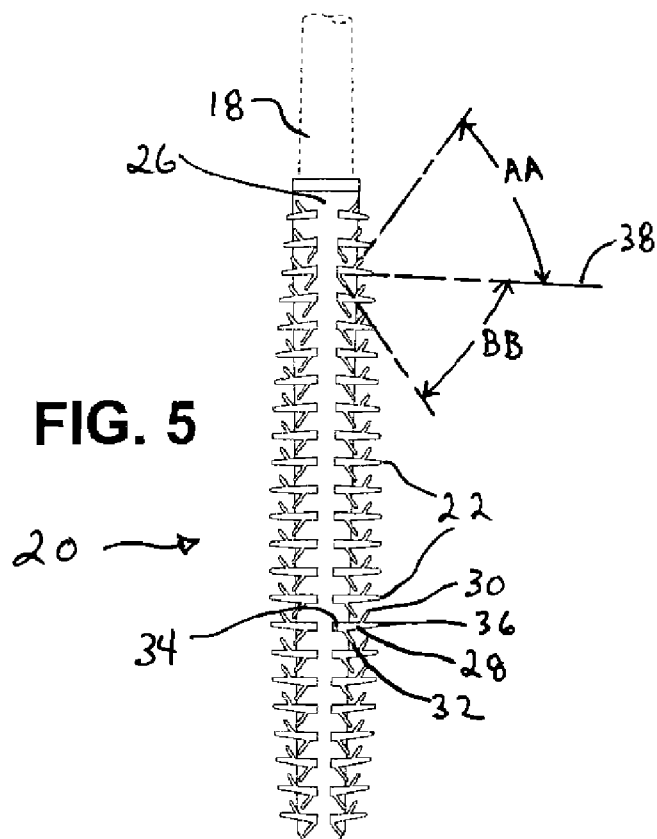
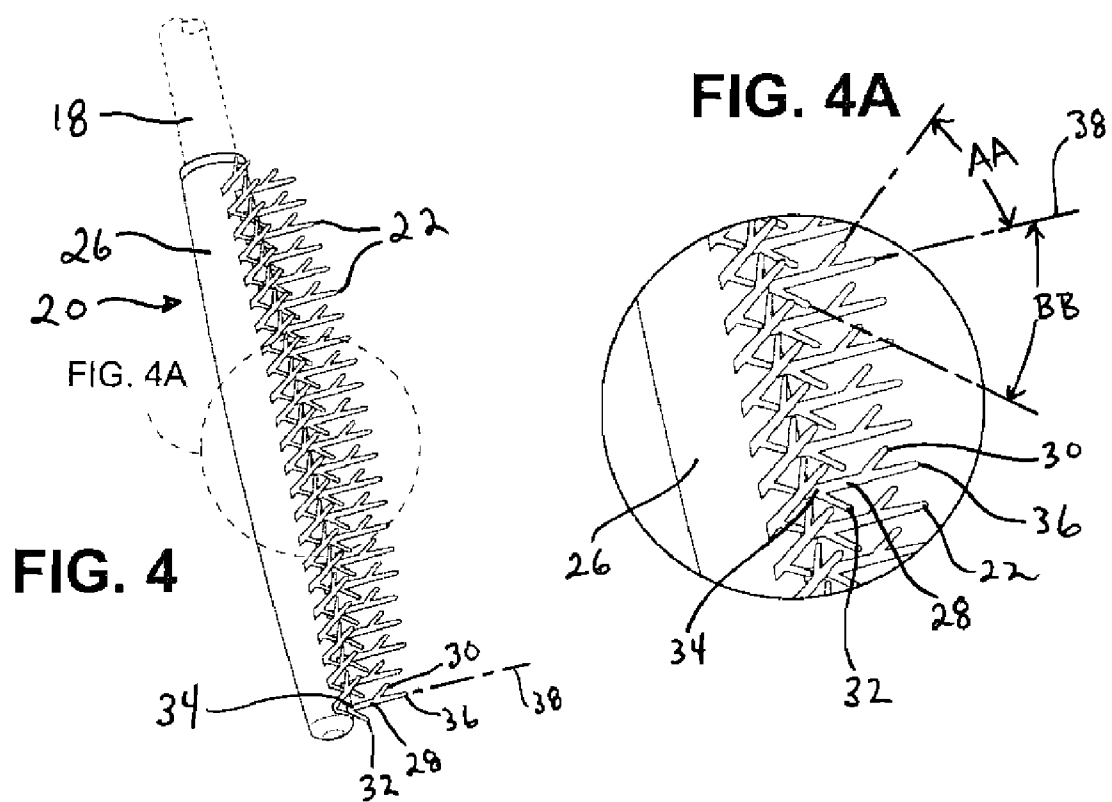


FIG. 3





BRANCHED APPLICATOR TINES AND AN APPLICATOR BRUSH HEAD INCORPORATING BRANCHED TINES

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to molded applicator tines and an applicator brush head made with such tines for applying cosmetic or coloring compounds to hair, eyelashes, eyebrows, etc.

[0003] 2. Background

[0004] Brush heads with molded tines, bristles or teeth for applying mascara, color, dye, tint, treatment or other hair, lash or brow products are well known.

[0005] Applicator brushes with molded tines (as opposed to, for example, brushes with fiber bristles secured between the branches of a twisted wire core, or tufts of bristles secured by staples in holes in a solid base, backbone, rod or core) generally comprise several rows of tines either integrally molded, over-molded or assembled onto a core. The known brushes generally have tines arranged in a circular duplication along the longitudinal axis of the brush core. In other words, the tines are arranged in repeated radially extending rings along the length of the core. Tines in adjacent rings form rows of tines. The brushes generally have 6 to 12 rows of tines. Each row has a plurality of tines. Generally, the profile, shape or design of each of the tines is the same throughout the brush head. Also each tine generally has a circular or semi-circular cross-section.

[0006] A drawback with known molded tine brush heads is, for example, the diminished ability to comb and separate lashes after mascara or other product has been applied. Also, molded tine brushes may not grip, for example, an eyelash shaft to the same degree as the fibers of a twisted wire core brush head.

[0007] Accordingly, there is a need for a molded tine brush head with improved ability to comb and separate lashes after mascara or other product has been applied, and there is a need for a molded tine brush head with an improved ability to grip lashes.

BRIEF SUMMARY OF THE INVENTION

[0008] A cosmetic applicator brush head has a plurality of molded tines, each with a main shaft and a first and a second branch extending from the shaft. The first branch extends at a point between the base of the shaft and the free end of the shaft. The second branch extends from the shaft at a point between the base of the shaft and the first branch. The first and second branches extend in a radial direction from the shaft at an angle of 5° to 90° relative to the free end and to a longitudinal axis of the shaft.

[0009] The cosmetic applicator brush head has a base adapted to be secured to a rod with a cap. A plurality of molded tines extends from the base. Each of the plurality of molded tines has a main shaft having a first end secured to the base, and an opposite free end. The main shaft defines a longitudinal axis and a length taken from the first end to the free end. A first branch extends from the main shaft at a point between the first end and the free end. The first branch extends in a radial direction from the main shaft at an angle of 5° to 90° relative to the free end and to the longitudinal axis of the main shaft. A second branch extends from the main shaft at a point between the first end and up to and including a height of the

first branch on the shaft. The second branch extends radially from the main shaft at an angle of 5° to 90° relative to the free end and to the longitudinal axis. The brush head is adapted to load, deposit and doctor at least one of mascara, color, dye, tint, treatment and other hair, lash and brow products. The brush head is also adapted to comb and separate eyelashes, eyebrow hairs or hair shafts.

[0010] The invention also relates to a tine extending from a cosmetic applicator brush head. The tine has a main shaft with a first end adapted to be secured to the base, and an opposite free end. The main shaft defines a longitudinal axis and has a length taken from the first end to the free end. A first branch extends from the main shaft at a point between the first end and the free end. The first branch extends in a radial direction from the main shaft at an angle of 5° to 90° relative to the free end of the shaft and to the longitudinal axis of the shaft. A second branch extends from the main shaft at a point between the first end and up to and including a height of the first branch on the shaft. The second branch extends radially from the shaft at an angle of 5° to 90° relative to the free end and to the longitudinal axis of the shaft. The tine is adapted to load, deposit and doctor at least one of mascara, color, dye, tint, treatment and other hair, lash and brow products, and is adapted to comb and separate eyelashes, eyebrow hairs or hair shafts.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1 is an elevation and partial sectional view of a mascara package incorporating the brush head with molded tines of a first embodiment of the present invention;

[0012] FIG. 2 is a perspective view of the brush head with molded tines of the first embodiment shown in FIG. 1;

[0013] FIG. 3 is an elevation view of the brush head with molded tines of the first embodiment shown in FIG. 1;

[0014] FIG. 4 is a perspective view of a second embodiment of the brush head with molded tines of the present invention;

[0015] FIG. 4A is an enlarged view of the branched applicator tines of the present invention; and

[0016] FIG. 5 is an elevation view of the second embodiment of the brush head with molded tines shown in FIG. 4.

DETAILED DESCRIPTION OF THE INVENTION

[0017] Referring now to FIG. 1, a mascara package incorporating a cosmetic applicator brush head with molded tines of a first embodiment of the present invention is shown. The package includes a vial 2 (shown in a sectional view) defining a storage reservoir 6 for product P. The vial has a wiper 4 and a neck 8 defining an opening 10 for receiving an applicator 12 and for withdrawing product P. The applicator 12 includes a cap 16 adapted to be received on the neck 8 for closing the vial 2. Internal threads (not shown) inside the cap are provided to mate with external threads 14 on the neck 8 to secure the cap 16 on the vial. A rod 18 depends from the cap and supports at an opposite end a cosmetic applicator brush head 20. An axis 24 is defined through the brush head 20. The applicator brush head 20 has a base 26 adapted to be secured to the rod 18. The base 26 supports at least one molded tine 22, and preferably a plurality of tines 22, that extend radially from the base 26 relative to the axis 24.

[0018] For clarity, “tines” are generally understood to be prongs extending from an implement. “Bristles” are generally understood to be stiff, hair-like structures. “Teeth” are generally understood to be projecting parts each resembling a tooth

in shape or function, as on a comb, gear, or saw. As used herein, the terms “tines”, “bristles” or “teeth” in singular or plural form are used interchangeably to designate any thin, stiff prong, projection, projecting part or structure extending from a supporting backbone, rod, core or base. Preferably, the tines, bristles and teeth are adapted to load, deposit and doctor mascara, color, dye, tint, treatment or other hair, lash or brow products, as well as combing and separating individual lashes, brow hairs and hair shafts.

[0019] As illustrated in FIG. 4A, each tine 22 has a main shaft 28 with a base end or first end 34 secured to the base 26 of the brush head 20. The shaft 28 has an opposite free end 36. The shaft defines a longitudinal axis 38, and the shaft 28 has a length taken from the first end 34 to the free end 36. A first branch 30 extends from the shaft 28 at a point between the first end 34 and the free end 36. The first branch 30 extends in a radial direction from the main shaft at an angle AA of 5° to 90° relative to the free end 36 and to the longitudinal axis 38 of the shaft 28. A second branch 32 extends from the shaft 28 at a point between the first end 34 and up to and including a height of the first branch 30 on the shaft 28. The second branch 32 extends radially from the shaft 28 at an angle BB of 5° to 90° relative to the free end 36 and to the longitudinal axis 38. The brush head 20 is adapted to load, deposit and doctor at least one of mascara, color, dye, tint, treatment and other hair, lash and brow products, and is adapted to comb and separate eyelashes, eyebrow hairs or hair shafts.

[0020] As illustrated in FIGS. 1-3, each row of tines 22 can be the same, configured in a circular repetition along the axis 24 of the brush head 20. The branches 30, 32 may be straight (as shown) or curved (not illustrated). Each tine 22 and respective branch or branches 30, 32 may be provided with any cross-section suitable to the intended purposes of the brush head. The distribution of the branches 30, 32 along the shaft 28 may be at the same height relative to the first end, or may be located at different heights. Adjacent tines 22 on a brush head 20 may have branches 30, 32 located at the same height, or adjacent tines 22 on a brush head 20 may have branches 30, 32 located at different heights. Adjacent tines 22 may be identical in shape, configuration and dimensions, or may be different in at least one of shape, configuration and dimensions. Similarly, branches 30, 32 on adjacent tines 22 may be identical in shape, configuration and dimensions, or may be different in at least one of shape, configuration and dimensions. Each row of tines 22 may have identical tines or may have different tines and/or different branches. Rows of branched tines may be alternated with rows of tines having no branches. Alternatively, within each row, tines with branches 30, 32 may be alternated with tines having no branches. The possible variations and combinations are infinite.

[0021] While the embodiments described herein are illustrated with each tine 22 of the plurality of tines having first and second branches, 30 and 32 respectively, it will be understood that the brush head may include some tines with only one branch (the first branch 30) and/or some tines with no branches at all. It is the intention of the inventors that as long as at least some of the tines 22 of the brush include a first branch 30, or a first branch 30 and second branch 32, the invention is embodied in the brush. For example, each row of tines can include the branched tines of the invention alone, or alternatively, a mix of the branched tines of the invention and conventional tines (e.g., no branches).

[0022] The first branch 30 and second branch 32 may extend from the shaft 24 in the same direction. Alternatively,

the first branch 30 may extend from the shaft 24 in a first radial direction and the second branch 32 may extend from the shaft 24 in a second radial direction. The second radial direction may be opposite the first radial direction as illustrated in the Figures.

[0023] The angle of the first branch 30 relative to the longitudinal axis 38 may be the same as the angle of the second branch 32, or the angles of the first branch 30 and second branch 32 may be different angles. The angle AA, BB is 5° to 90° relative to the free end 36 and to the longitudinal axis 38 of the shaft 28. At least one of the first branch 30 or the second branch 32 has a length that is at least 5% of the length of the shaft 28.

[0024] In a first embodiment of the invention shown in FIGS. 1-3, the plurality of tines 22 are arranged in equally spaced rows to radially extend in a configuration that is substantially 360 degrees around the base 26. Alternatively, the rows of teeth may be offset from each other. In a second embodiment of the invention illustrated in FIGS. 4-5, the plurality of tines 22 are arranged in two rows that extend substantially from one side of the base 26 only. It will be understood that the illustrated embodiments are examples, and that the numbers and dimensions of tines 22 and the configuration of the tines 22 in rows may be selected to be suitable for a particular formula or application purpose.

[0025] While brush heads 20 with a plurality of tines 22 are described above as embodying the invention, the invention is also embodied in the individual tines 22 as illustrated, for example, in FIG. 4A. Each tine 22 has a main shaft 28 defining a longitudinal axis 38. A first end 34 of the shaft 28 is adapted to be secured to the base 26 of the brush head 20. The shaft 28 has an opposite free end 36. A length of the shaft 28 is taken from the first end 34 to the free end 36. A first branch 30 extends from the shaft 28 at a point between the first end 34 and the free end 36. A second branch 32 extends from the shaft 28 at a point between the first end 34 and up to and including a height of the first branch 30 on the shaft 28. The first branch 30 and a second branch 32 extend in a radial direction from the shaft 28 at an angle AA, BB, respectively, of 5° to 90° relative to the free end 36 and the longitudinal axis 38 of the shaft 28. The tine 22 is adapted to load, deposit and doctor at least one of mascara, color, dye, tint, treatment and other hair, lash and brow products, and wherein the tine is adapted to comb and separate eyelashes, eyebrow hairs or hair shafts.

[0026] Whether in a plurality of tines or as an individual tine, the first branch 30 may extend from the shaft 28 in a first radial direction and the second branch 32 may extend from the shaft 28 in the same radial direction or in a second different radial direction. The second radial direction may be opposite the first radial direction. The angle AA of the first branch 30 may be the same as the angle BB of the second branch 32, or the angles of the first branch 30 and second branch 32 may be different. Preferably, at least one of the first branch 30 or the second branch 32 has a length that is at least 5% of the length of the shaft 28.

[0027] The brush head tines 22 and the brush head 20 may be made by injection molding (or any other suitable molding means) from any suitable plastic material. Preferred materials are, such as, for example, polymers including silicone elastomers, thermoplastic elastomers (e.g., styrene-ethylene-butylene-styrene block copolymer—SEBS), vinyl elastomers (EVA), thermoplastic polyester elastomers (e.g., Hytrel® from DuPont de Nemours), thermoplastic polyurethane elas-

tomers (Pelethane® from Dow Plastic), Nitrile or EPDM. Hardness of the material is preferably from about 35 MPa (35 Shore D Hytrel® from DuPont de Nemours) to about 1180 MPa (82 Shore D Hytrel® from DuPont de Nemours). More preferably, tensile modulus ranges from about 95 MPa (45 Shore D Hytrel® from DuPont de Nemours) to about 570 MPa (72 Shore D Hytrel® from DuPont de Nemours). Most preferably, tensile modulus ranges from about 200 MPa (55 Shore D Hytrel® from DuPont de Nemours) to about 280 MPa (63 Shore D Hytrel® from DuPont de Nemours).

[0028] The tines **22** may have any size, shape and spacing suitable for intended purposes and functions, e.g., application, arrangement and/or separation of hairs, eyebrows or eyelashes. Preferably, but not necessarily, the tines **22** have an average height ranging from about 0.1 mm to about 10 mm. More preferably, the tines **22** have an average height from about 0.5 mm to about 7 mm and, most preferably, from about 0.8 mm to about 5 mm. The average cross-sectional diameter of the tines **22** preferably ranges from about 0.1 mm to about 2 mm. More preferably, the cross-sectional diameter of the tines ranges from about 0.2 mm to about 1.5 mm, and most preferably from about 0.3 mm to about 0.9 mm.

[0029] The brush head and tines of the invention may be used for the application of any cosmetic or treatment product to eyelashes, eyebrows or hair, including, for example, mascara, eyelashes formula (e.g., color, tint, dye, treatment, sealer, builder, volumizer, etc.), eyebrow formula, etc., in either liquid or gel form.

[0030] While the invention has been described and illustrated as embodied in preferred forms of construction, it will be understood that various modifications may be made in the structure and arrangement of the parts without departing from the spirit and the scope of the invention recited in the following claims.

What is claimed is:

1. A cosmetic applicator brush head, the brush head comprising:

- a base adapted to be secured to a rod with a cap;
- a plurality of molded tines extending from the base, each of the plurality of molded tines having:
 - a main shaft having a first end secured to the base, and an opposite free end, the main shaft defining a longitudinal axis and a length taken from the first end to the free end; and
 - a first branch extending from the main shaft at a point between the first end and the free end, the first branch extending in a radial direction from the main shaft at an angle of 5° to 90° relative to the longitudinal axis of the main shaft;

wherein the brush head is adapted to load, deposit and doctor at least one of mascara, color, dye, tint, treatment and other hair, lash and brow products, and wherein the brush head is adapted to comb and separate eyelashes, eyebrow hairs or hair shafts.

2. The cosmetic applicator brush head of claim **1** further comprising a second branch extending from the main shaft at a point between the first end and up to and including a height of the first branch on the shaft, the second branch extending radially from the main shaft at an angle of 5° to 90° relative to the longitudinal axis.

3. The cosmetic applicator brush head of claim **2** wherein the first branch extends from the main shaft in a first radial direction and the second branch extends from the main shaft in a second radial direction.

4. The cosmetic applicator brush head of claim **3** where in the second radial direction is opposite the first radial direction.

5. The cosmetic applicator brush head of claim **2** wherein the angle of the first branch is the same as the angle of the second branch.

6. The cosmetic applicator brush head of claim **1** wherein the first branch has a length that is at least 5% of the length of the shaft.

7. The cosmetic applicator brush head of claim **2** wherein at least one of the first branch or the second branch has a length that is at least 5% of the length of the shaft.

8. The cosmetic applicator brush head of claim **1** wherein the tines are made from a material selected from one of silicone elastomer, thermoplastic elastomer, vinyl elastomer, thermoplastic polyester elastomer, thermoplastic polyurethane elastomer, Nitrile and EPDM.

9. The cosmetic applicator brush head of claim **1** wherein the tines are made from a material having a hardness of from about 35 MPa to about 1180 MPa.

10. The cosmetic applicator brush head of claim **1** wherein the tines are made from a material having a hardness of from about 95 MPa to about 570 MPa.

11. The cosmetic applicator brush head of claim **1** wherein the tines are made from a material having a hardness of from about 200 MPa to about 280 MPa.

12. The cosmetic applicator brush head of claim **1** wherein the tines have an average height ranging from about 0.1 mm to about 10 mm.

13. The cosmetic applicator brush head of claim **1** wherein the tines have an average height from about 0.5 mm to about 7 mm.

14. The cosmetic applicator brush head of claim **1** wherein the tines have an average height from about 0.8 mm to about 5 mm.

15. The cosmetic applicator brush head of claim **1** wherein the tines have an average cross-sectional diameter of from about 0.1 mm to about 2 mm.

16. The cosmetic applicator brush head of claim **1** wherein the tines have an average cross-sectional diameter of from about 0.2 mm to about 1.5 mm.

17. The cosmetic applicator brush head of claim **1** wherein the tines have an average cross-sectional diameter of from about 0.3 mm to about 0.9 mm.

18. A tine for a cosmetic applicator brush head with a base, the tine comprising:

- a main shaft having a first end adapted to be secured to the base, and an opposite free end, the main shaft defining a longitudinal axis and a length taken from the first end to the free end; and
- a first branch extending from the main shaft at a point between the first end and the free end, the first branch extending in a radial direction from the main shaft at an angle of 5° to 90° relative to the longitudinal axis of the main shaft;

wherein the tine is adapted to load, deposit and doctor at least one of mascara, color, dye, tint, treatment and other hair, lash and brow products, and wherein the tine is adapted to comb and separate eyelashes, eyebrow hairs or hair shafts.

19. The tine of claim **18** further comprising a second branch extending from the main shaft at a point between the first end and up to and including a height of the first branch on the

shaft, the second branch extending radially from the main shaft at an angle of 5° to 90° relative to the longitudinal axis.

20. The tine of claim 19 wherein the first branch extends from the main shaft in a first radial direction and the second branch extends from the main shaft in a second radial direction.

21. The tine of claim 20 wherein the second radial direction is opposite the first radial direction.

22. The tine of claim 19 wherein the angle of the first branch is the same as the angle of the second branch.

23. The tine of claim 18 wherein the first branch has a length that is at least 5% of the length of the shaft

24. The tine of claim 19 wherein at least one of the first branch or the second branch has a length that is at least 5% of the length of the shaft.

25. The tine of claim 18 wherein the tine is made from a material selected from one of silicone elastomer, thermoplastic elastomer, vinyl elastomer, thermoplastic polyester elastomer, thermoplastic polyurethane elastomer, Nitrile and EPDM.

26. The tine of claim 18 wherein the tine is made from a material having a hardness of from about 35 MPa to about 1180 MPa.

27. The tine of claim 18 wherein the tine is made from a material having a hardness of from about 95 MPa to about 570 MPa.

28. The tine of claim 18 wherein the tine is made from a material having a hardness of from about 200 MPa to about 280 MPa.

29. The tine of claim 18 wherein the tine has a height ranging from about 0.1 mm to about 10 mm.

30. The tine of claim 18 wherein the tine has a height from about 0.5 mm to about 7 mm.

31. The tine of claim 18 wherein the tine has a height from about 0.8 mm to about 5 mm.

32. The tine of claim 18 wherein the tine has a cross-sectional diameter of from about 0.1 mm to about 2 mm.

33. The tine of claim 18 wherein the tine has a cross-sectional diameter of from about 0.2 mm to about 1.5 mm.

34. The tine of claim 18 wherein the tine has a cross-sectional diameter of from about 0.3 mm to about 0.9 mm.

35. A cosmetic applicator brush head, the brush head comprising:

a base adapted to be secured to a rod with a cap;

a plurality of molded tines extending from the base, each of the plurality of molded tines having:

a main shaft having a first end secured to the base, and an opposite free end, the main shaft defining a longitudinal axis and a length taken from the first end to the free end;

a first branch extending from the main shaft at a point between the first end and the free end, the first branch extending in a radial direction from the main shaft at an angle of 5° to 90° relative to the longitudinal axis of the main shaft; and

a second branch extending from the main shaft at a point between the first end and up to and including a height of the first branch on the shaft, the second branch extending radially from the main shaft at an angle of 5° to 90° relative to the longitudinal axis;

wherein the brush head is adapted to load, deposit and doctor at least one of mascara, color, dye, tint, treatment and other hair, lash and brow products, and wherein the

brush head is adapted to comb and separate eyelashes, eyebrow hairs or hair shafts.

36. The cosmetic applicator brush head of claim 35 wherein the first branch extends from the main shaft in a first radial direction and the second branch extends from the main shaft in a second radial direction.

37. The cosmetic applicator brush head of claim 36 wherein the second radial direction is opposite the first radial direction.

38. The cosmetic applicator brush head of claim 35 wherein the angle of the first branch is the same as the angle of the second branch.

39. The cosmetic applicator brush head of claim 35 wherein at least one of the first branch or the second branch has a length that is at least 5% of the length of the shaft.

40. The cosmetic applicator brush head of claim 35 wherein the tines are made from a material selected from one of silicone elastomer, thermoplastic elastomer, vinyl elastomer, thermoplastic polyester elastomer, thermoplastic polyurethane elastomer, Nitrile and EPDM.

41. The cosmetic applicator brush head of claim 35 wherein the tines are made from a material having a hardness of from about 35 MPa to about 1180 MPa.

42. The cosmetic applicator brush head of claim 35 wherein the tines are made from a material having a hardness of from about 95 MPa to about 570 MPa.

43. The cosmetic applicator brush head of claim 35 wherein the tines are made from a material having a hardness of from about 200 MPa to about 280 MPa.

44. The cosmetic applicator brush head of claim 35 wherein the tines have an average height ranging from about 0.1 mm to about 10 mm.

45. The cosmetic applicator brush head of claim 35 wherein the tines have an average height from about 0.5 mm to about 7 mm.

46. The cosmetic applicator brush head of claim 35 wherein the tines have an average height from about 0.8 mm to about 5 mm.

47. The cosmetic applicator brush head of claim 35 wherein the tines have an average cross-sectional diameter of from about 0.1 mm to about 2 mm.

48. The cosmetic applicator brush head of claim 35 wherein the tines have an average cross-sectional diameter of from about 0.2 mm to about 1.5 mm.

49. The cosmetic applicator brush head of claim 35 wherein the tines have an average cross-sectional diameter of from about 0.3 mm to about 0.9 mm.

50. A tine for a cosmetic applicator brush head with a base, the tine comprising:

a main shaft having a first end adapted to be secured to the base, and an opposite free end, the main shaft defining a longitudinal axis and a length taken from the first end to the free end;

a first branch extending from the main shaft at a point between the first end and the free end, the first branch extending in a radial direction from the main shaft at an angle of 5° to 90° relative to the longitudinal axis of the main shaft; and

a second branch extending from the main shaft at a point between the first end and up to and including a height of the first branch on the shaft, the second branch extending radially from the main shaft at an angle of 5° to 90° relative to the longitudinal axis;

wherein the tine is adapted to load, deposit and doctor at least one of mascara, color, dye, tint, treatment and other hair, lash and brow products, and wherein the tine is adapted to comb and separate eyelashes, eyebrow hairs or hair shafts.

51. The tine of claim **50** wherein the first branch extends from the main shaft in a first radial direction and the second branch extends from the main shaft in a second radial direction.

52. The tine of claim **51** wherein the second radial direction is opposite the first radial direction.

53. The tine of claim **50** wherein the angle of the first branch is the same as the angle of the second branch.

54. The tine of claim **50** wherein at least one of the first branch or the second branch has a length that is at least 5% of the length of the shaft.

55. The tine of claim **50** wherein the tine is made from a material selected from one of silicone elastomer, thermoplastic elastomer, vinyl elastomer, thermoplastic polyester elastomer, thermoplastic polyurethane elastomer, Nitrile and EPDM.

56. The tine of claim **50** wherein the tine is made from a material having a hardness of from about 35 MPa to about 1180 MPa.

57. The tine of claim **50** wherein the tine is made from a material having a hardness of from about 95 MPa to about 570 MPa.

58. The tine of claim **50** wherein the tine is made from a material having a hardness of from about 200 MPa to about 280 MPa.

59. The tine of claim **50** wherein the tine has a height ranging from about 0.1 mm to about 10 mm.

60. The tine of claim **50** wherein the tine has a height from about 0.5 mm to about 7 mm.

61. The tine of claim **50** wherein the tine has a height from about 0.8 mm to about 5 mm.

62. The tine of claim **50** wherein the tine has a cross-sectional diameter of from about 0.1 mm to about 2 mm.

63. The tine of claim **50** wherein the tine has a cross-sectional diameter of from about 0.2 mm to about 1.5 mm.

64. The tine of claim **50** wherein the tine has a cross-sectional diameter of from about 0.3 mm to about 0.9 mm.

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