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(54) TOOTHBRUSH WITH MOVEABLE HEAD

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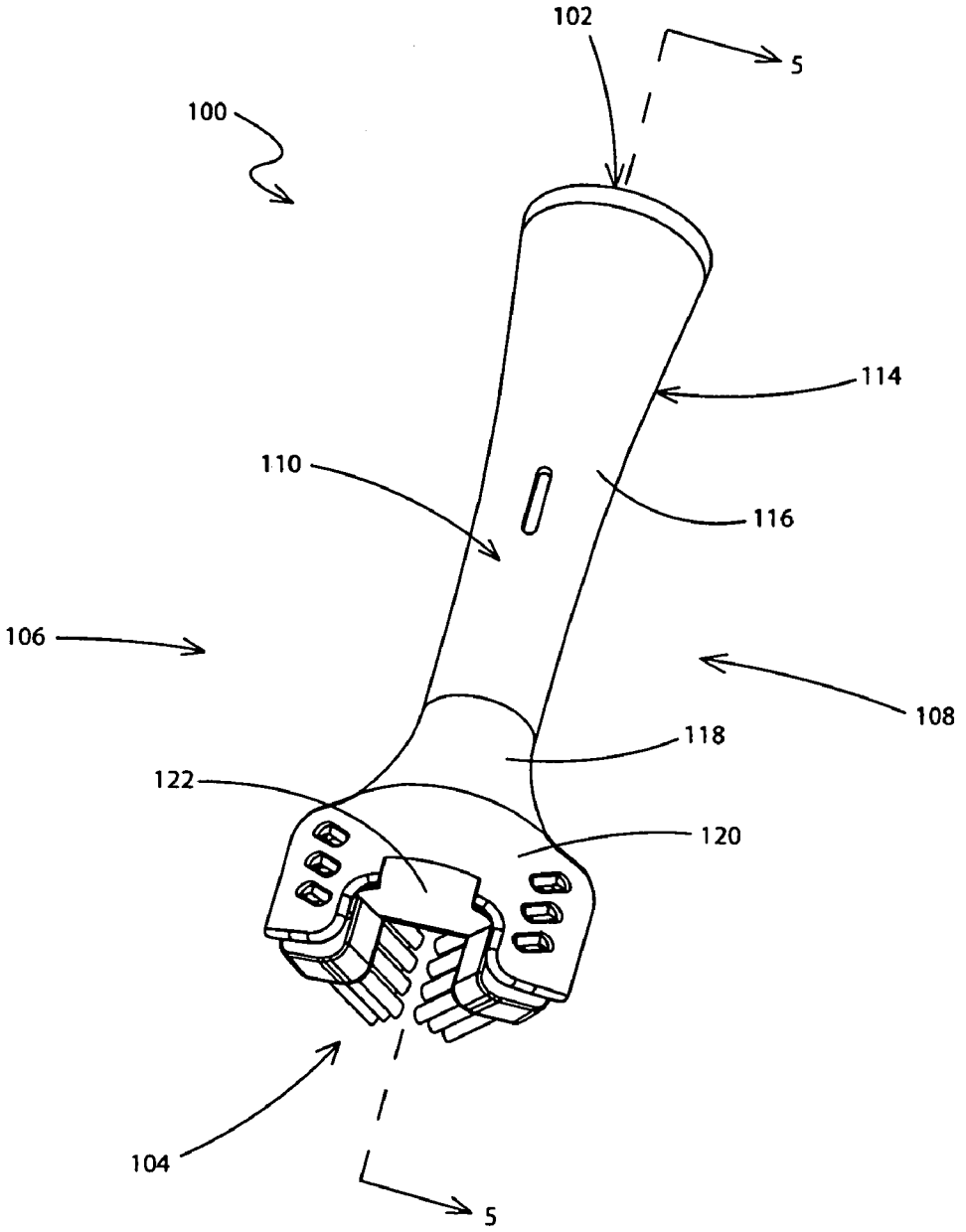
(57) **ABSTRACT**

A toothbrush head assembly for use with an electric toothbrush power handle includes a housing having a longitudinal direction, an oscillating member which oscillates reciprocally in the longitudinal direction, and a brush which oscillates rotatably about a longitudinally extending axis. The brush preferably includes twin brushes. Several mechanisms translate the reciprocal motion of the oscillating member into rotational motion of the brush.



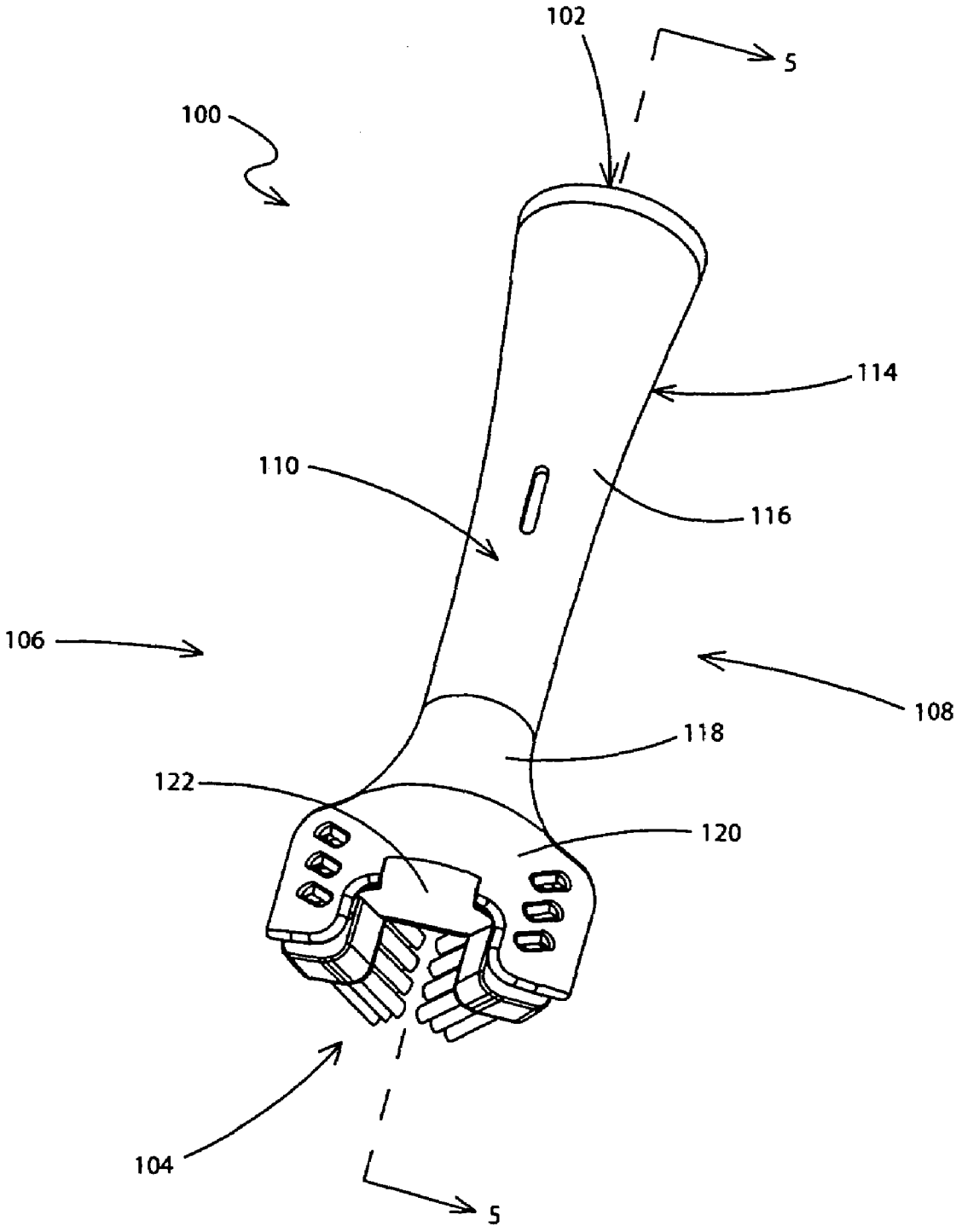


FIG.1

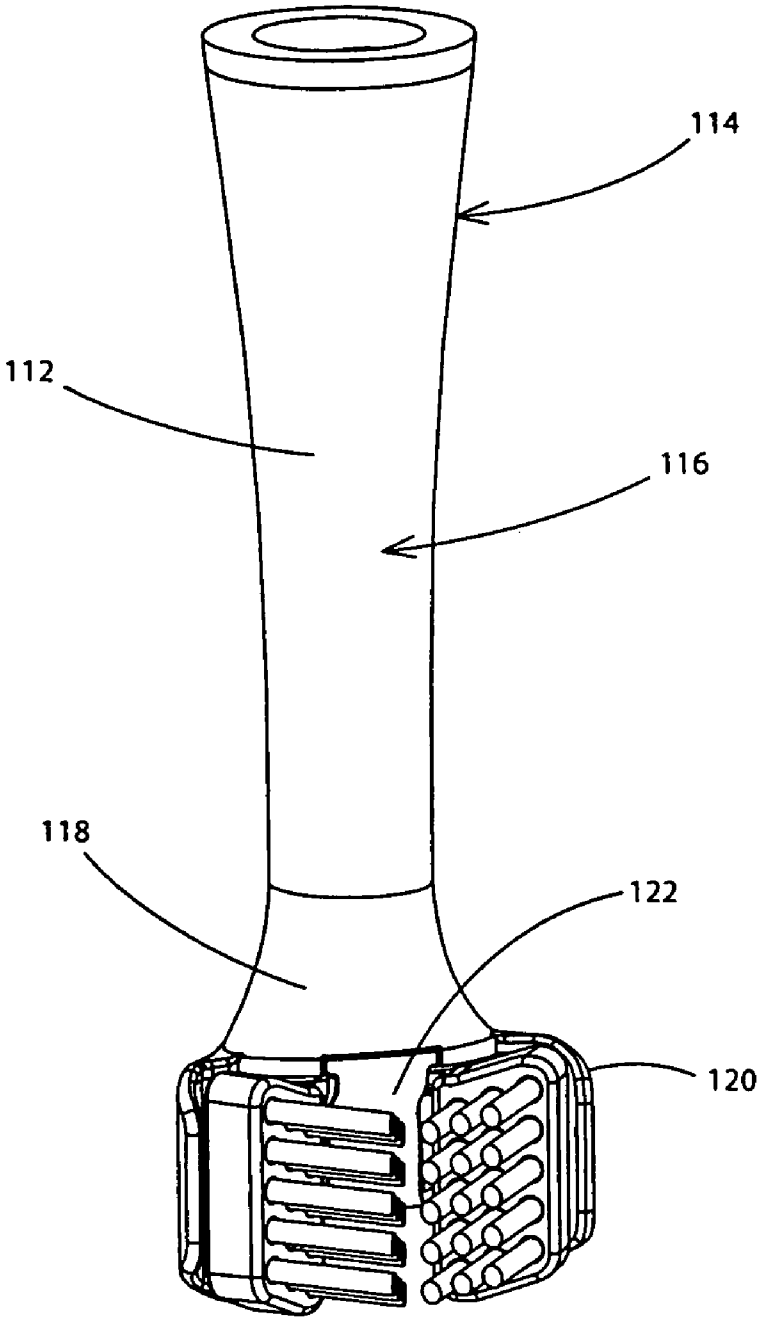


FIG.2

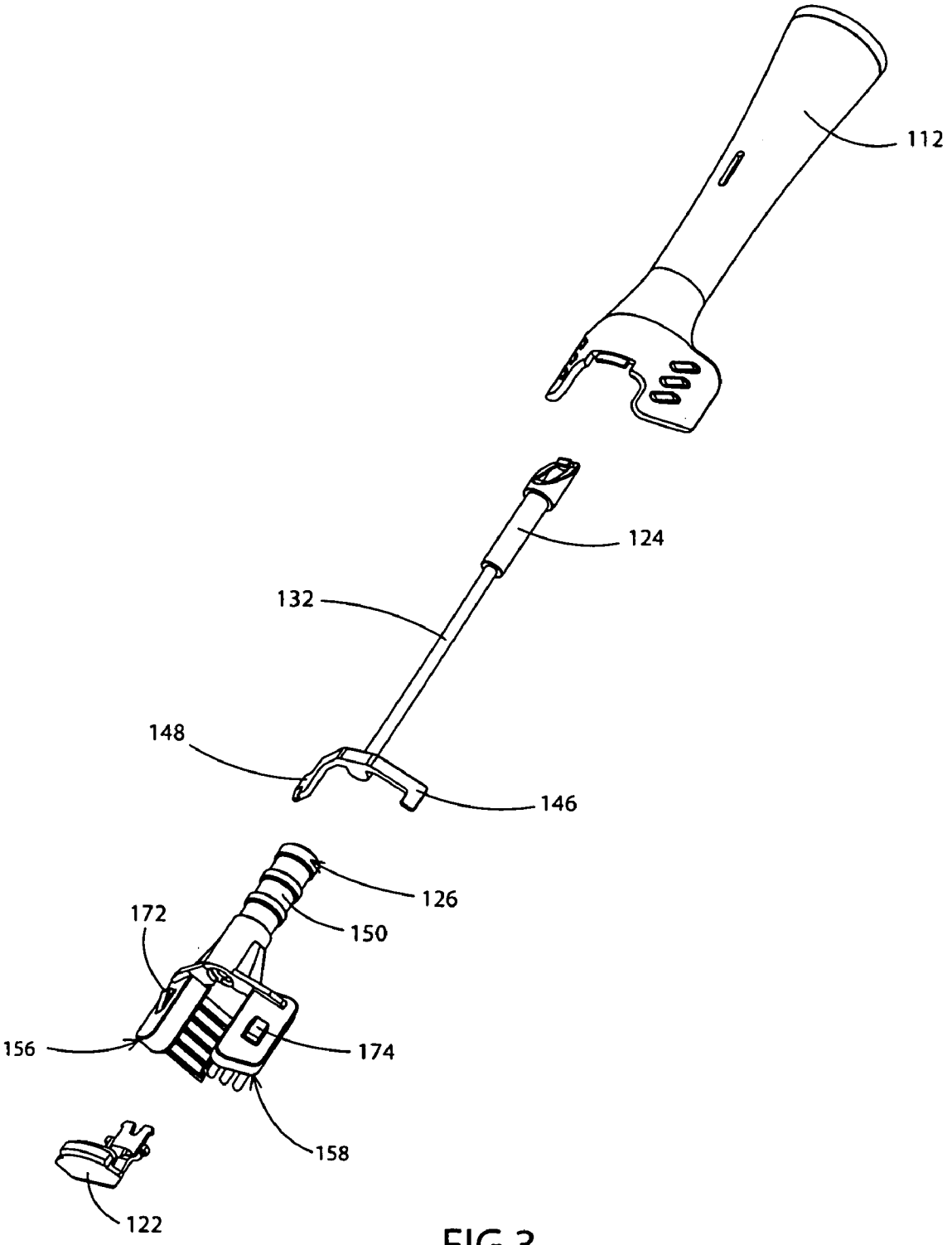


FIG.3

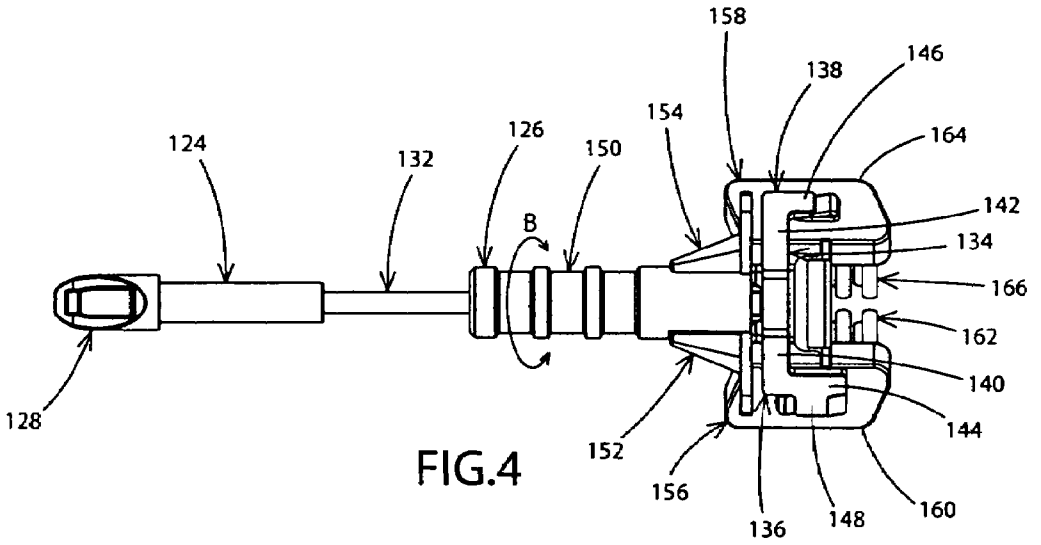


FIG.4

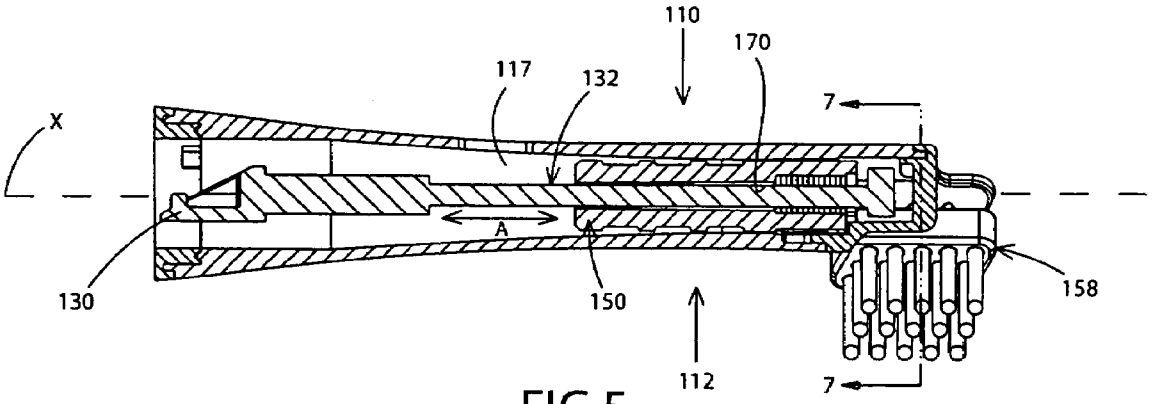


FIG.5

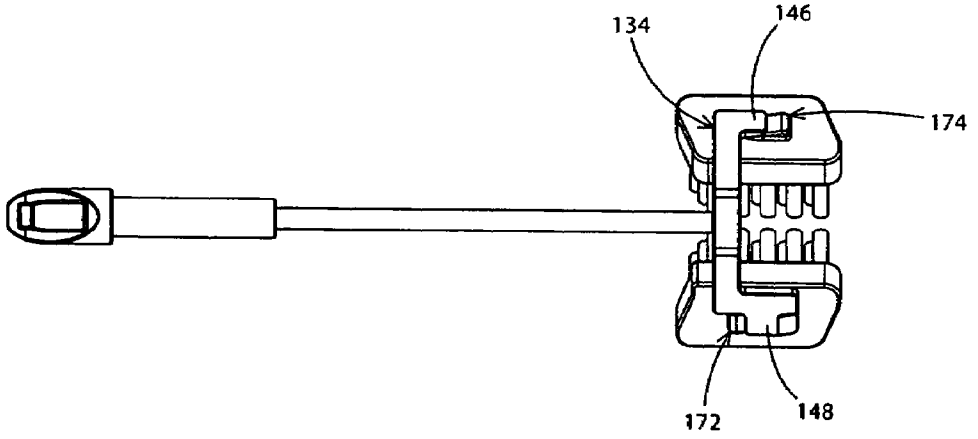


FIG.6

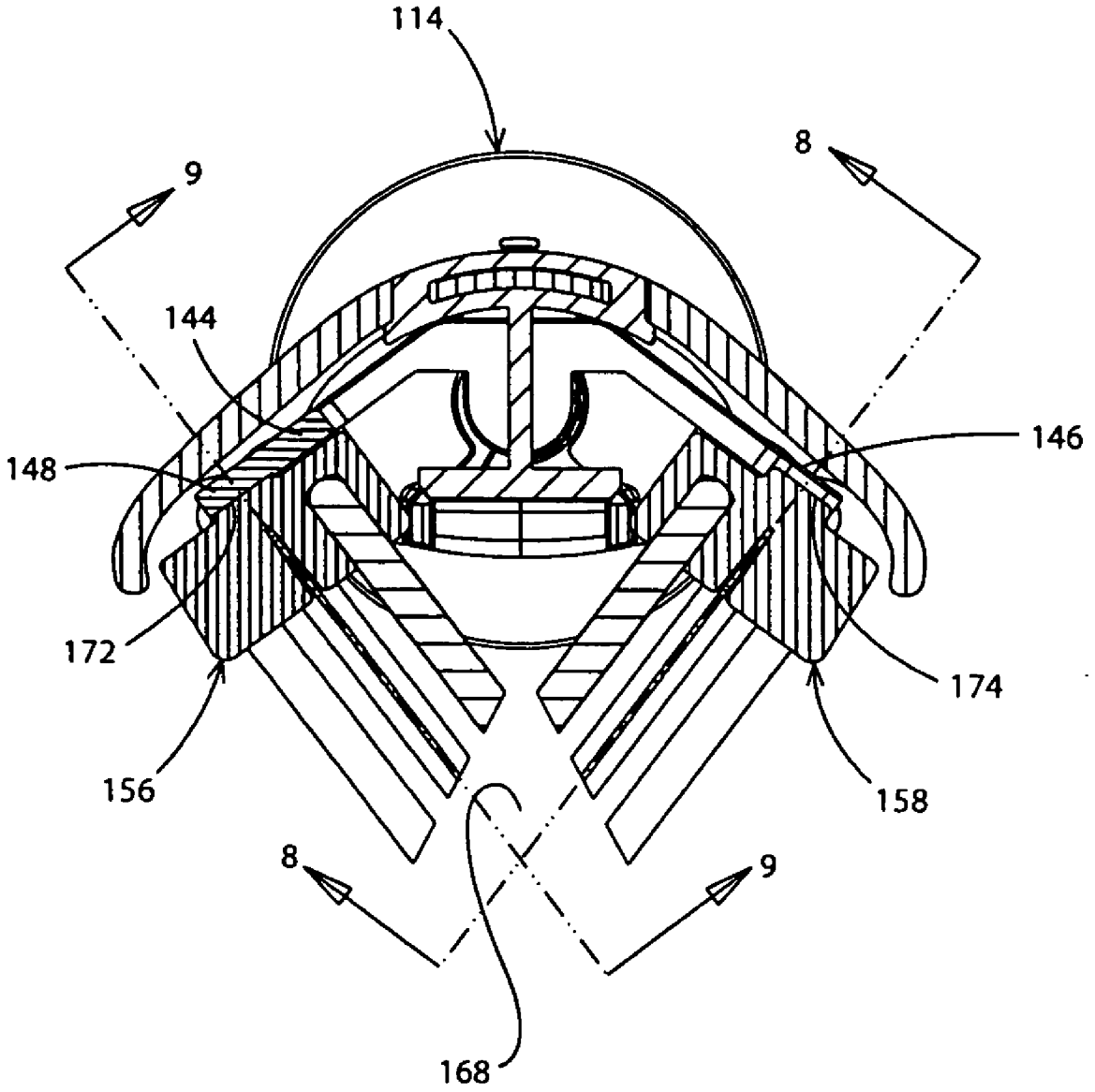


FIG.7

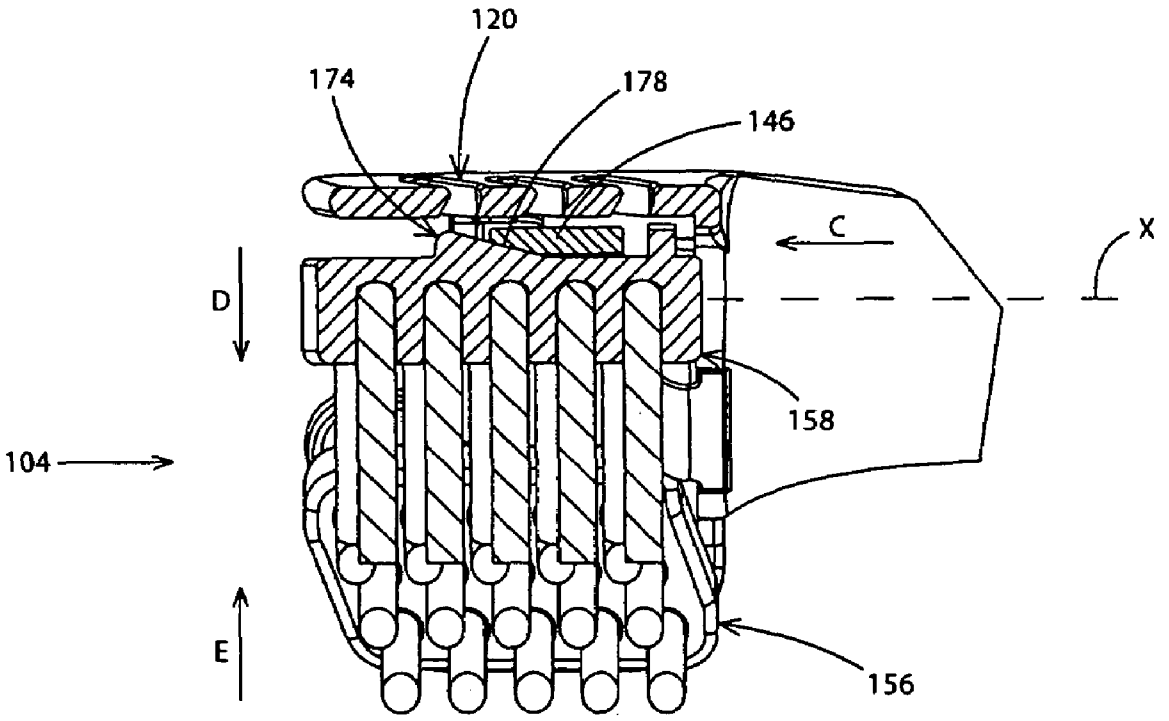


FIG.8

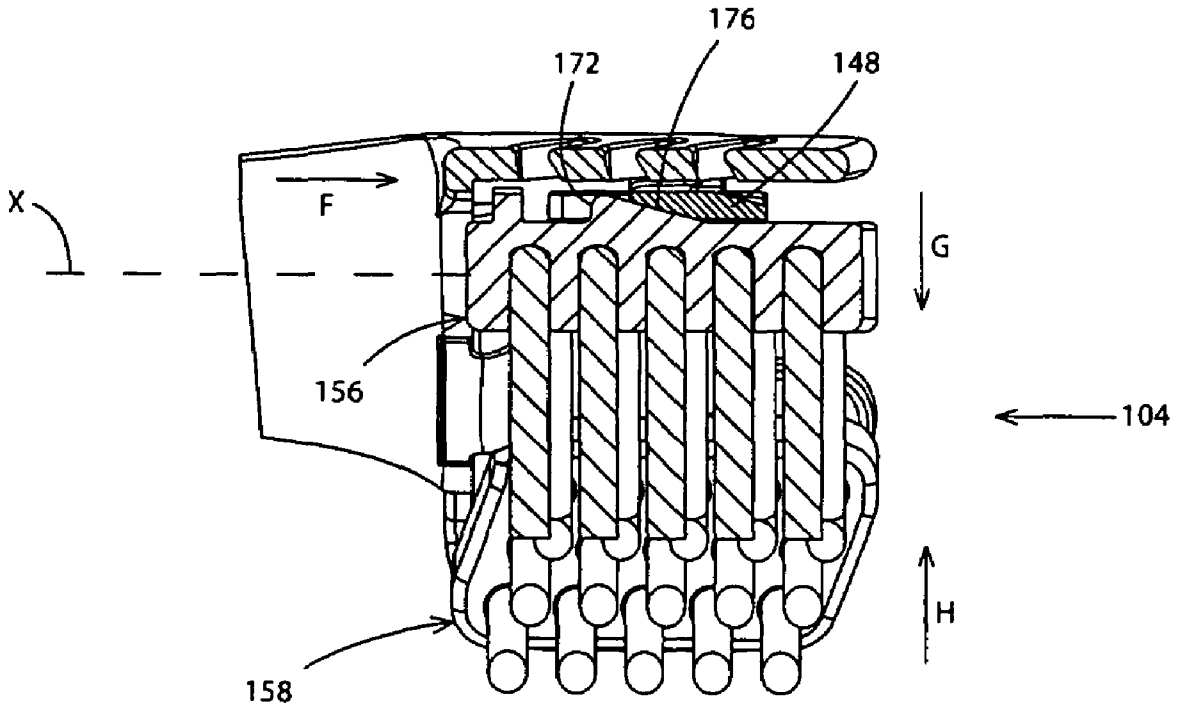


FIG.9

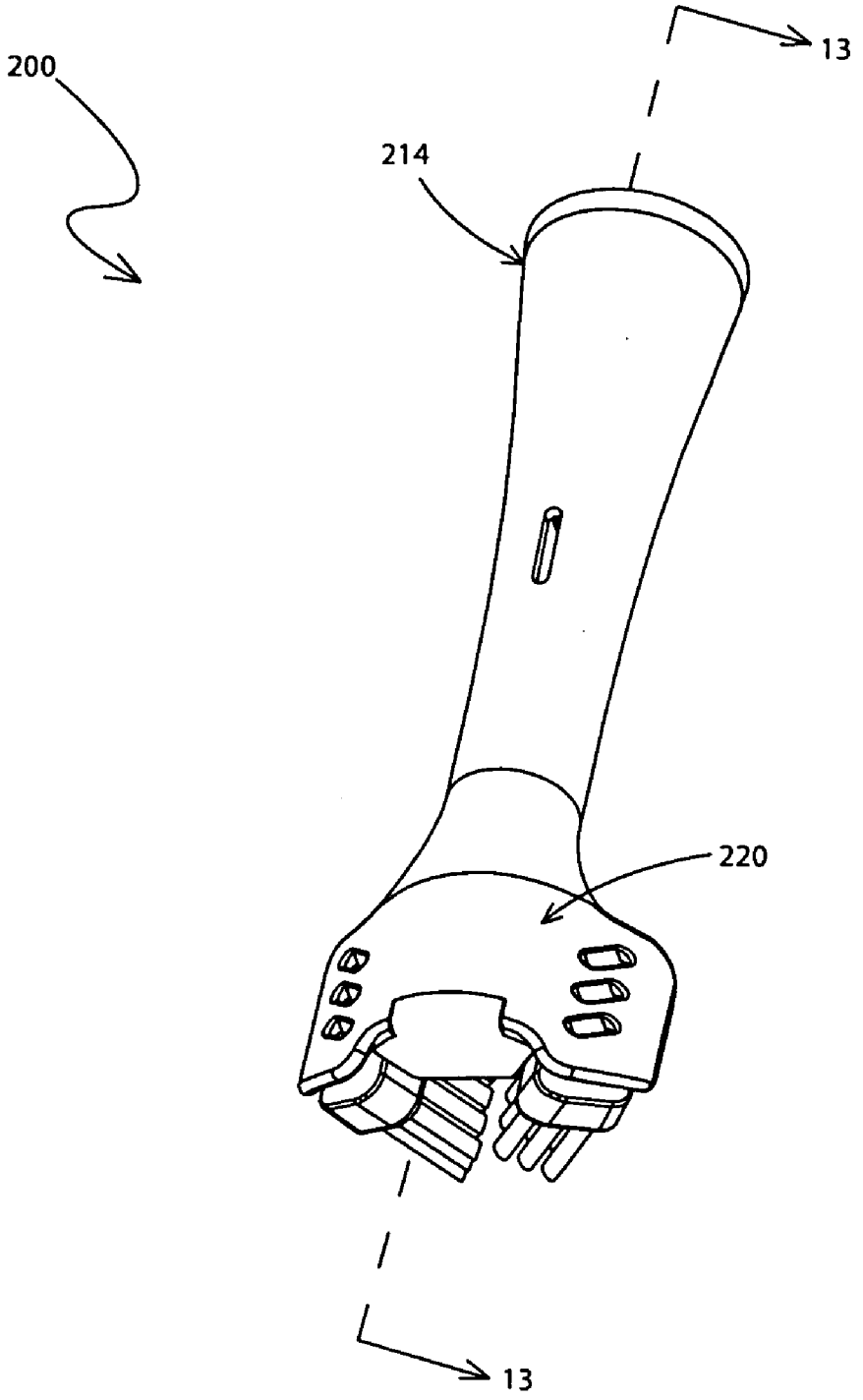


FIG.10

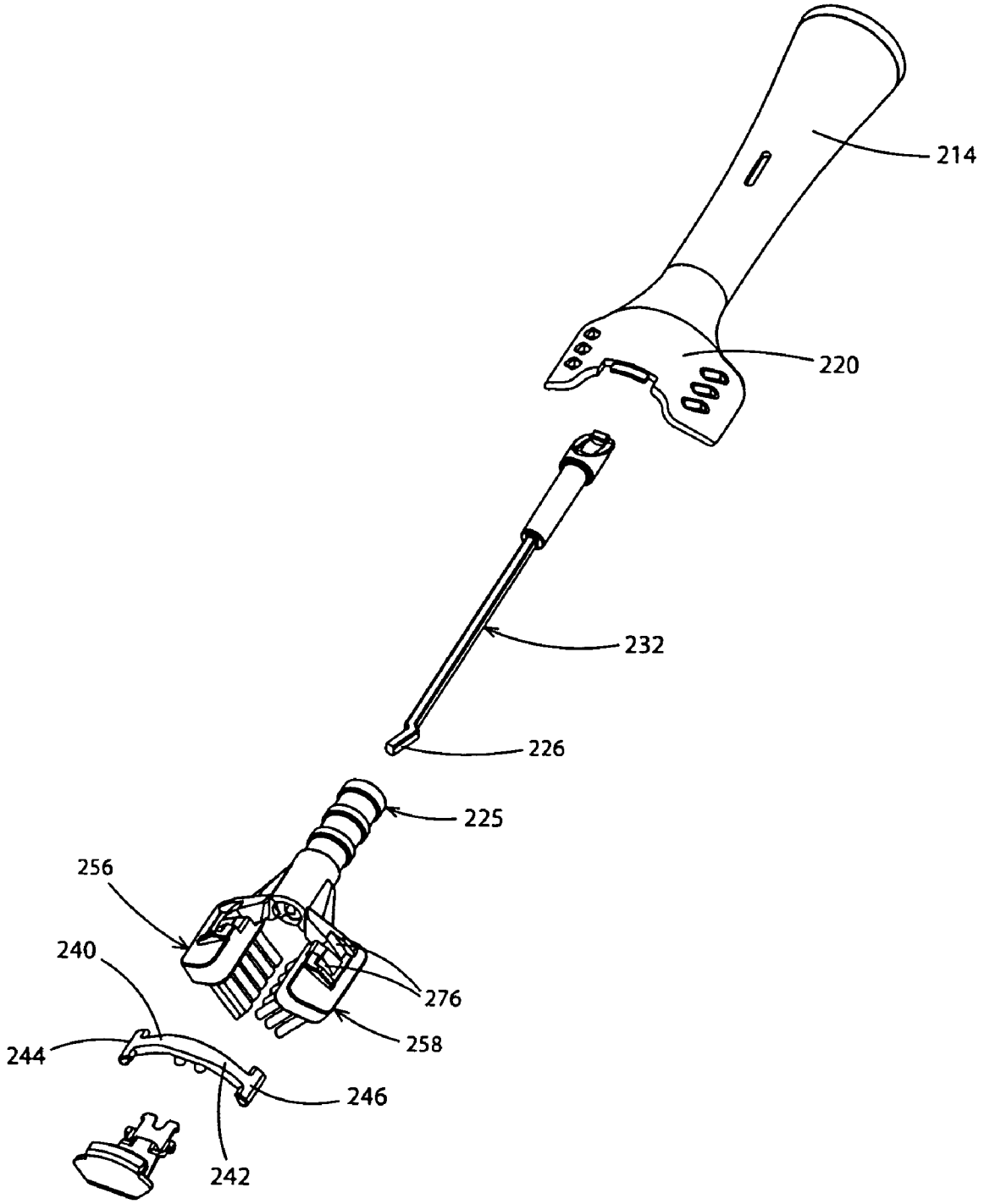
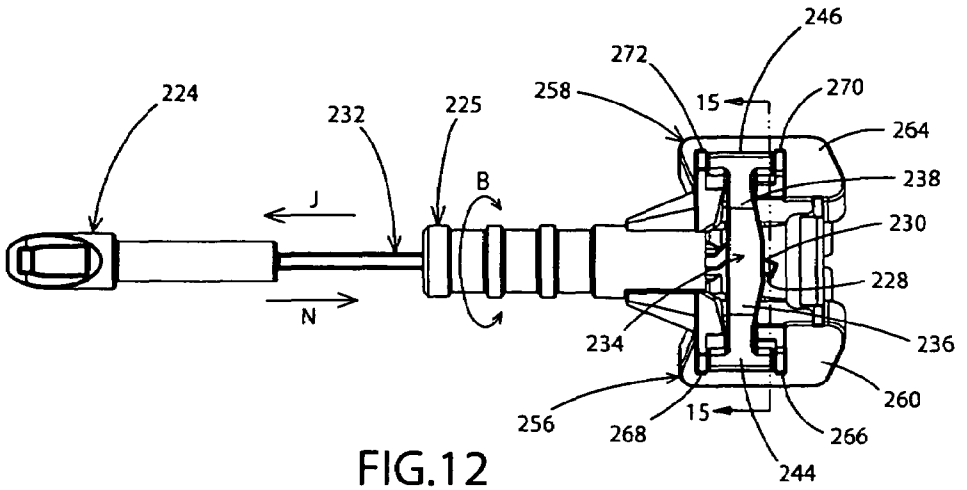


FIG.11



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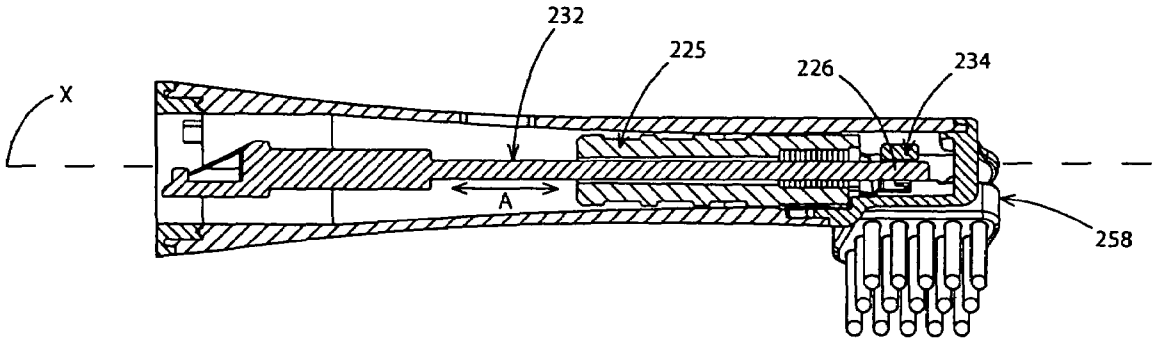

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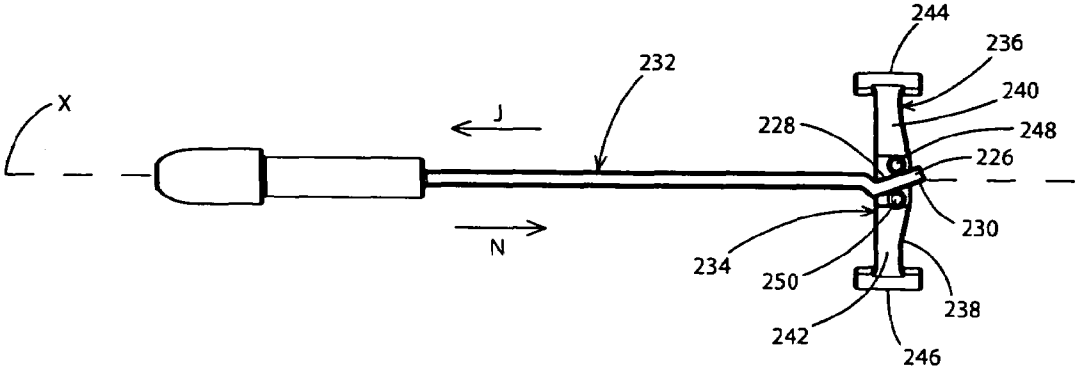

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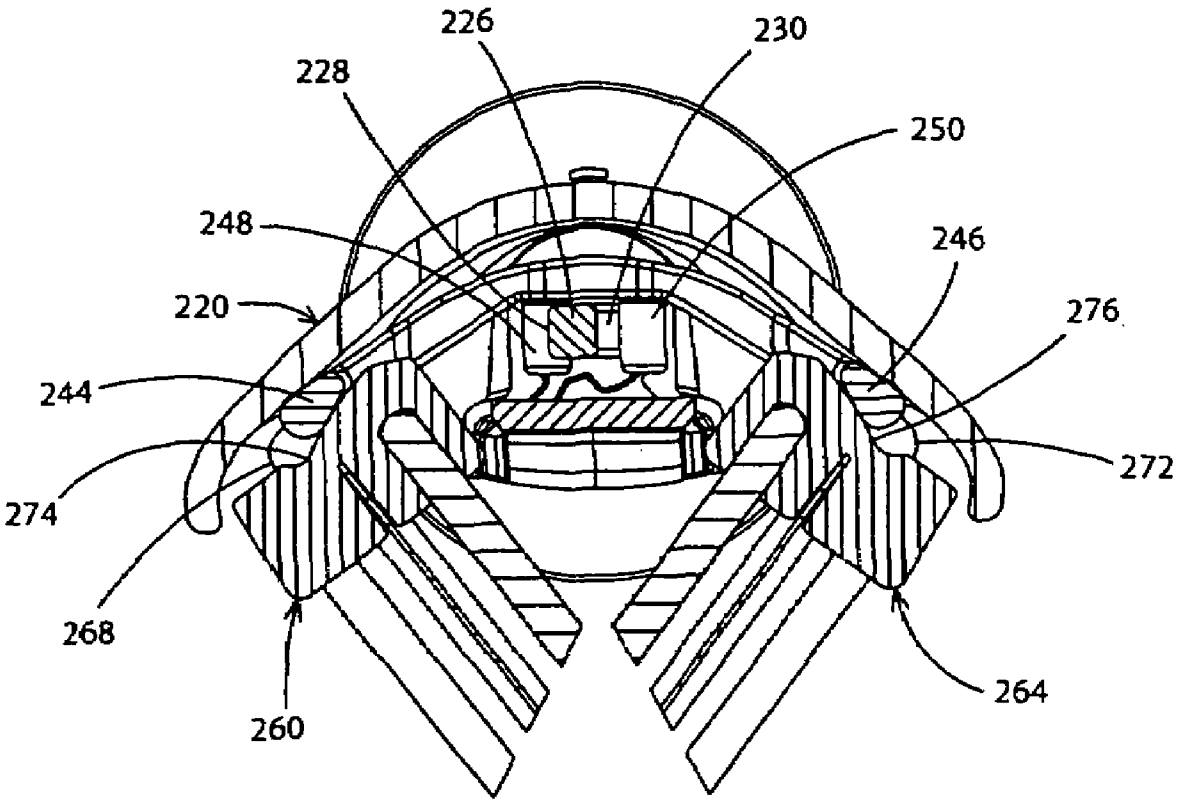

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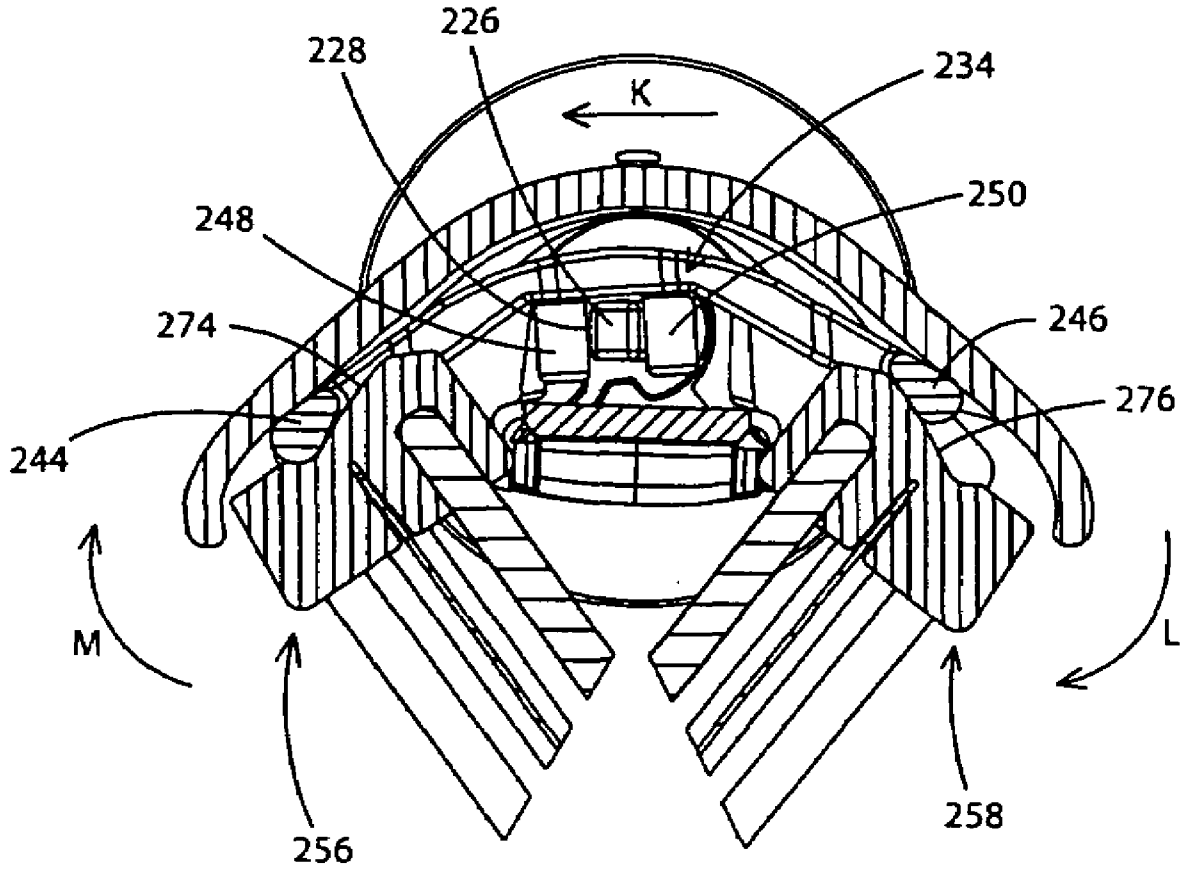

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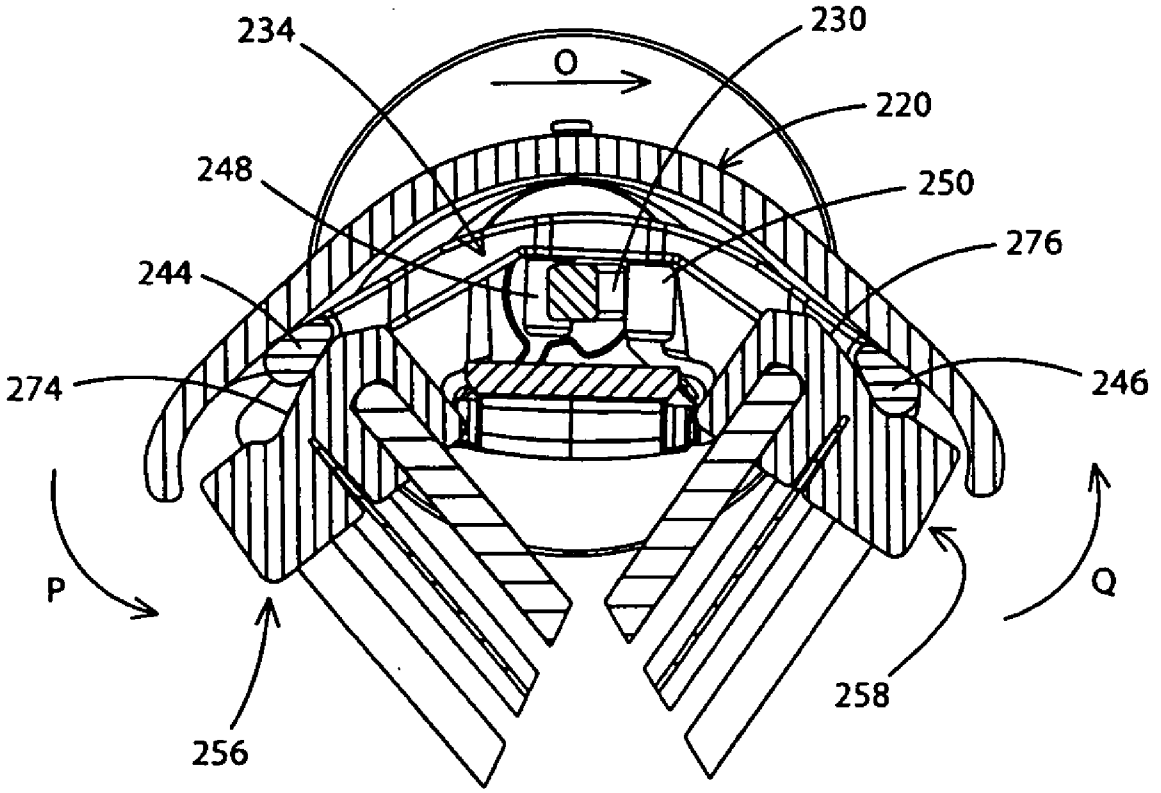

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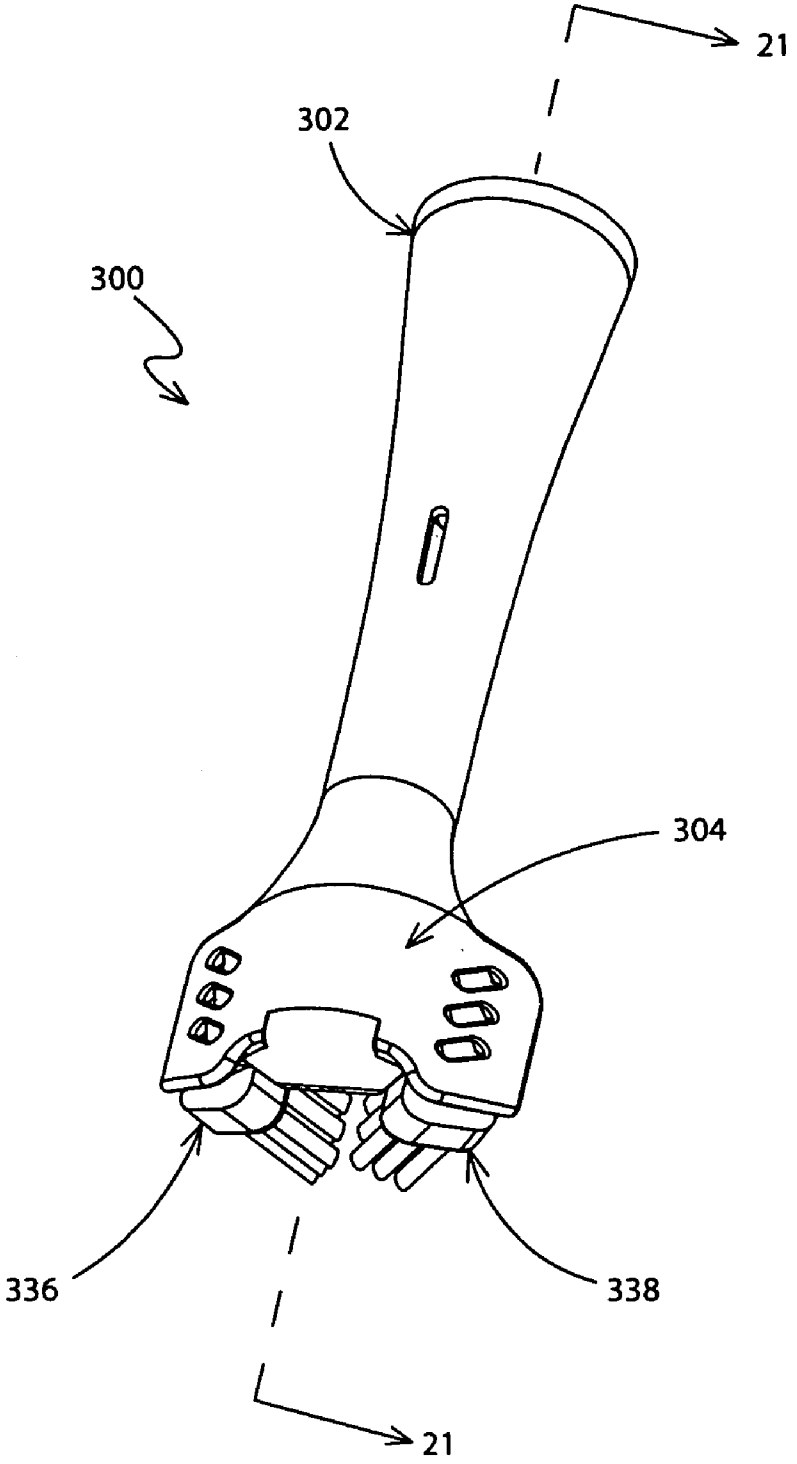

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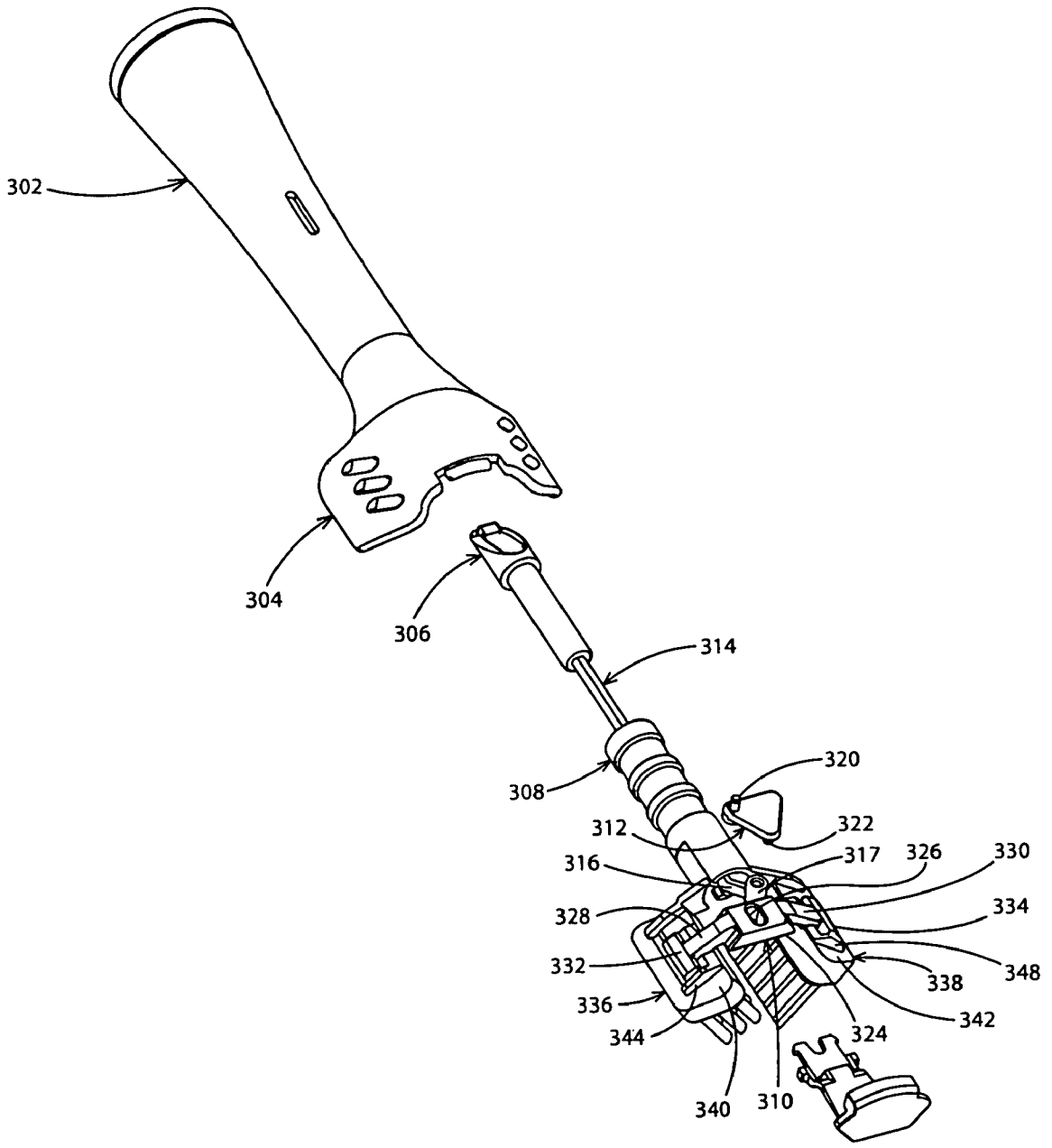
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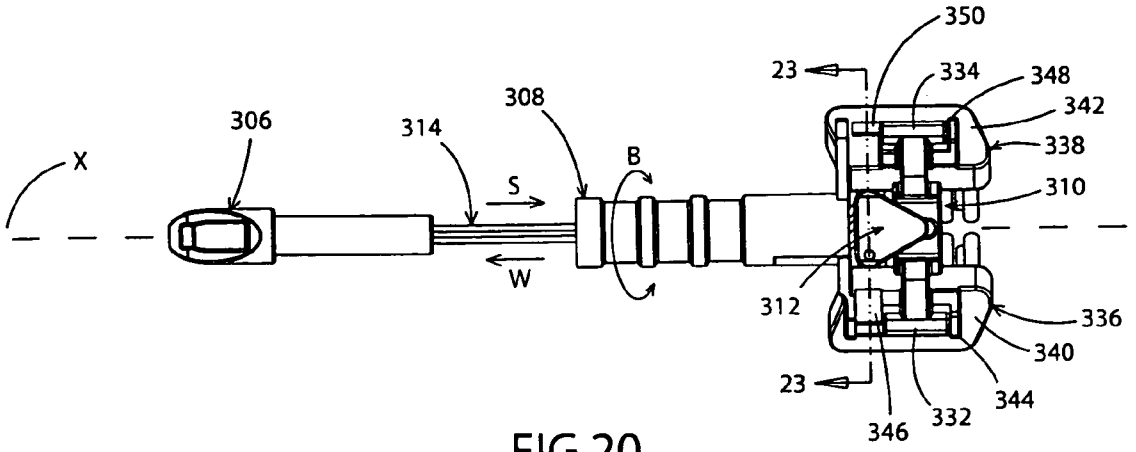
FIG.19



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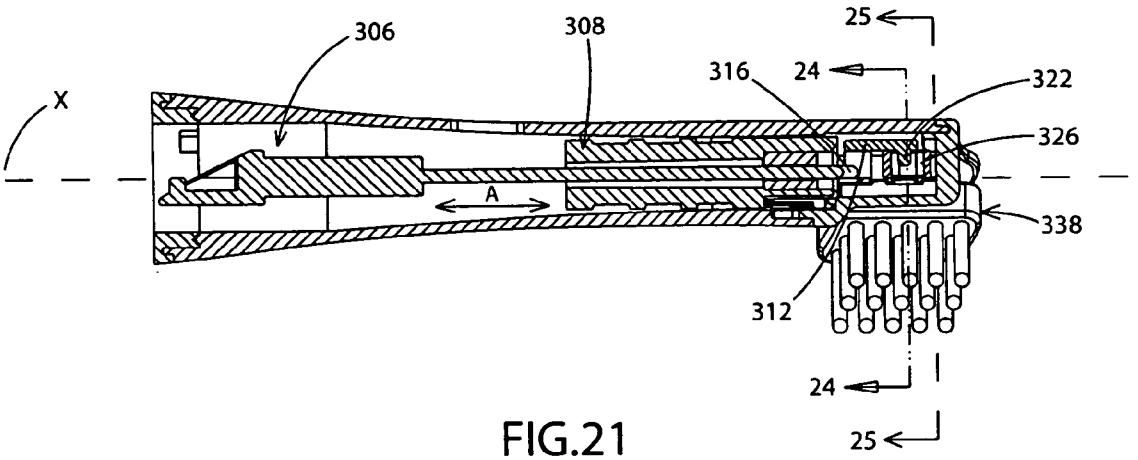
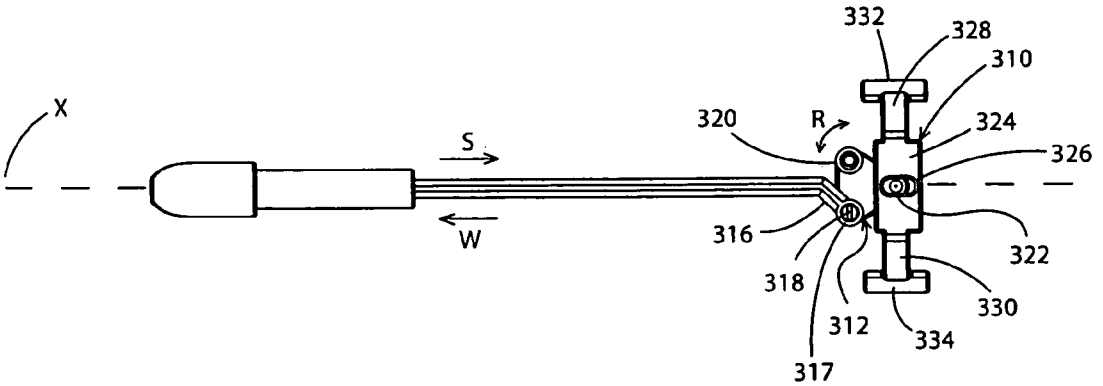


FIG.21



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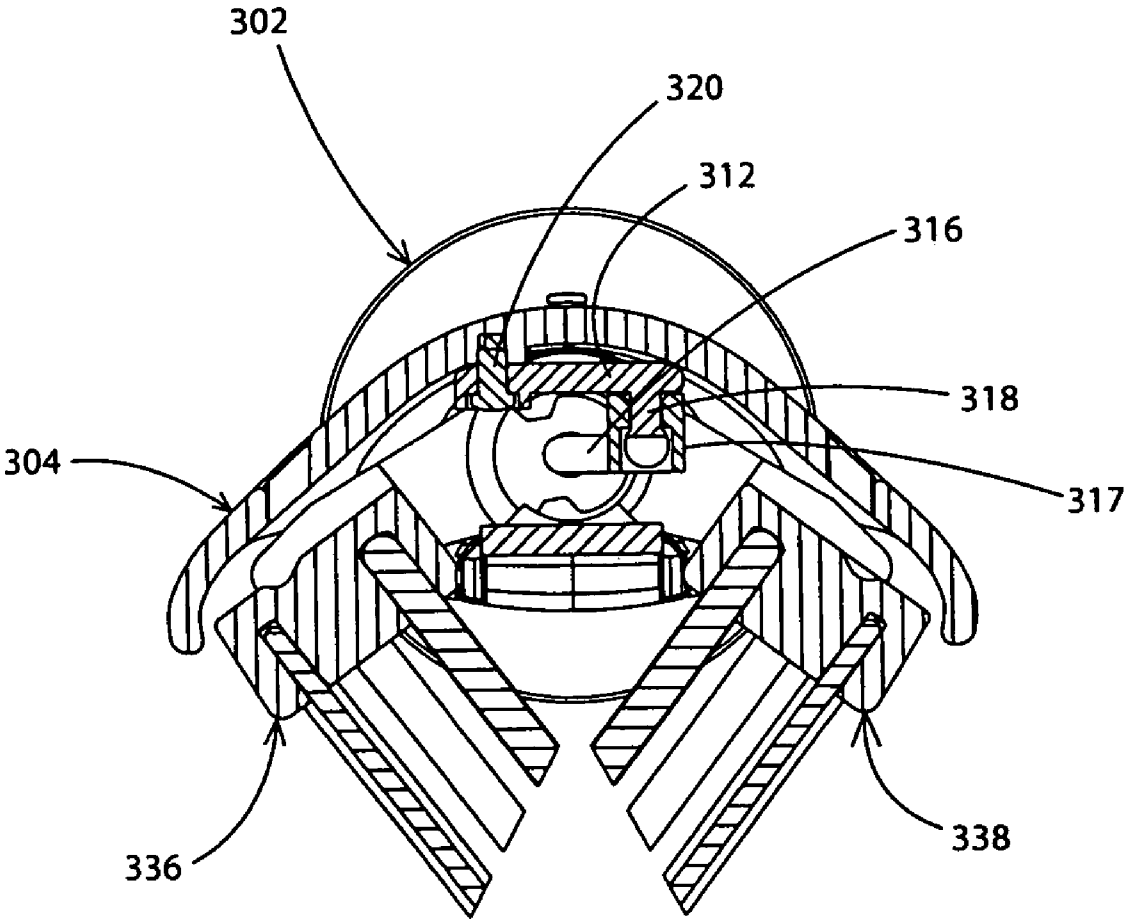

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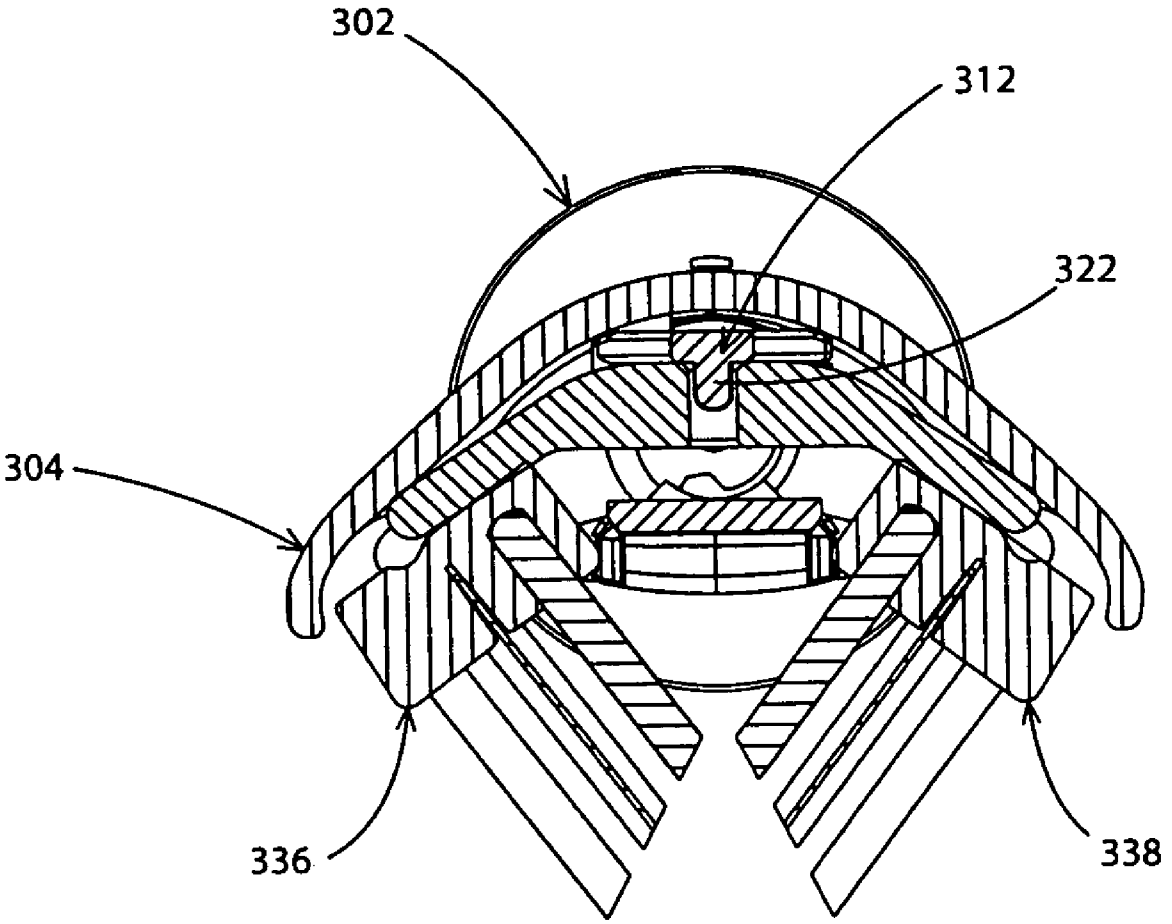

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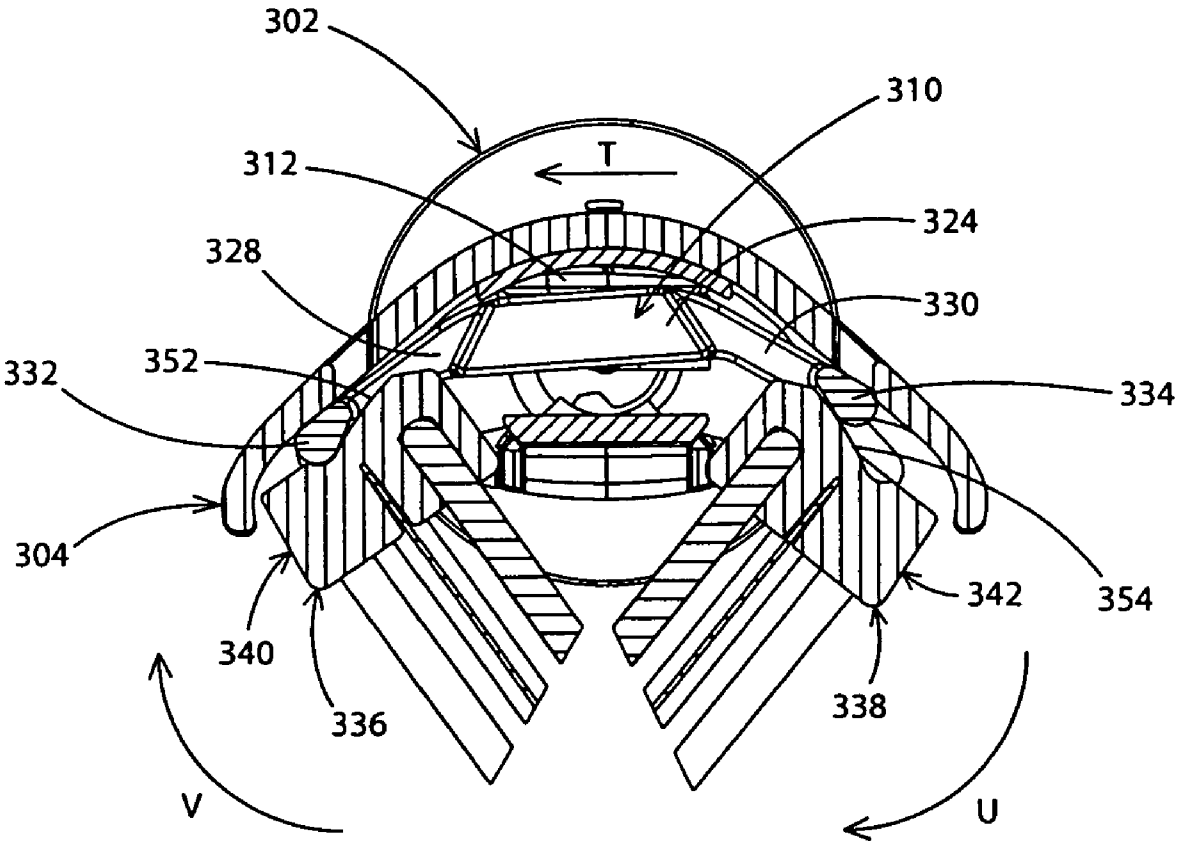

FIG.25

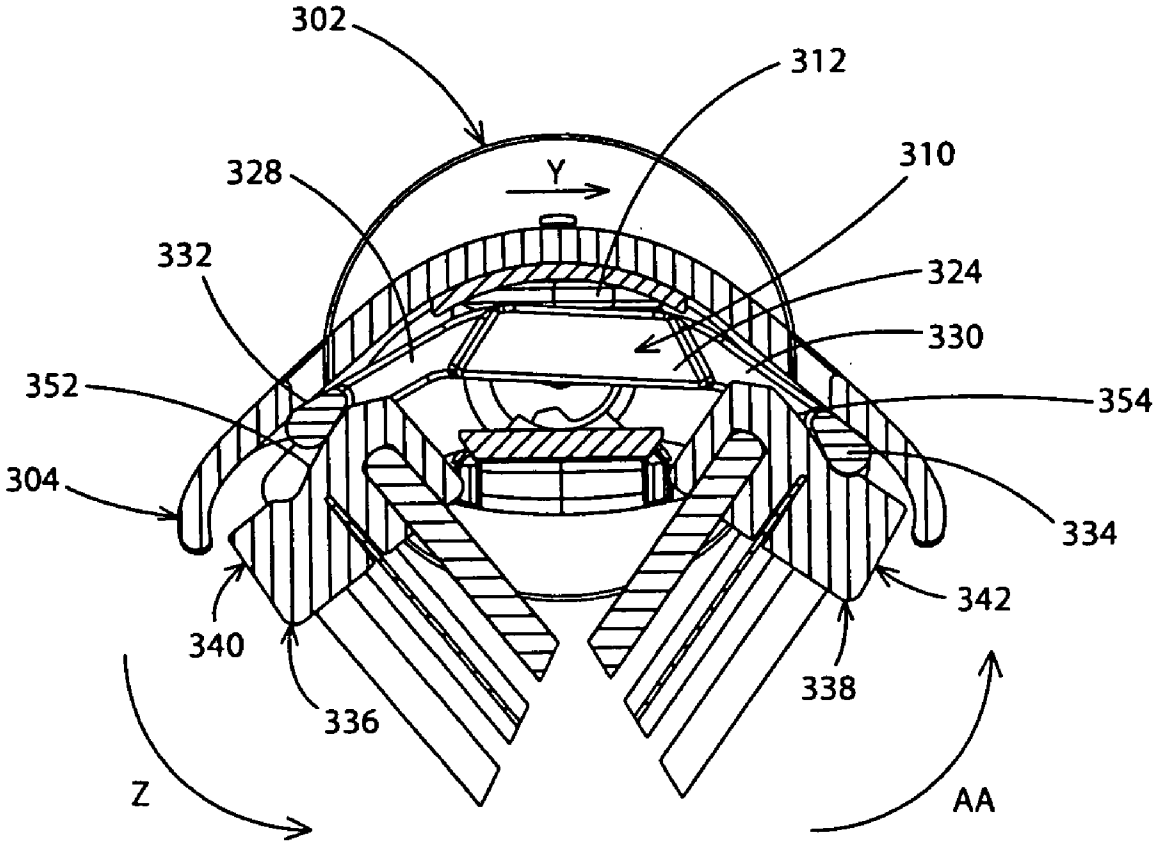

FIG.26

TOOTHBRUSH WITH MOVEABLE HEAD

BACKGROUND OF THE INVENTION

[0001] 1. Technical Field

[0002] This invention relates generally to toothbrushes. More particularly, the invention relates to electric toothbrushes. Specifically, the invention relates to an electric toothbrush having two heads and a mechanism for oscillating the two heads.

[0003] 2. Background Information

[0004] Manual and electric toothbrushes are well known in the art. Twin-headed brushes are also known which allow for the simultaneous cleaning of the lingual and buccal surfaces of the tooth. As disclosed in U.S. Pat. No. 6,381,794 to Porper et al., some of these twin-headed brushes are configured to rotatably oscillate about the longitudinal axis of the toothbrush. Said patent, which provides greater detail with regard to the prior art, is incorporated herein by reference. The present invention provides new mechanisms for oscillating such a twin-headed brush about the longitudinal axis.

BRIEF SUMMARY OF THE INVENTION

[0005] The present invention provides a toothbrush head assembly for use with an electric toothbrush power handle, the assembly comprising a housing having a longitudinal direction; an oscillating member which is disposed in the housing and which oscillates reciprocally in the longitudinal direction; and a brush which is mounted on the housing and which oscillates rotatably about a longitudinally extending axis.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0006] FIG. **1** is a perspective view showing the top of the first embodiment of the toothbrush of the present invention.

[0007] FIG. **2** is a perspective view showing the bottom of the first embodiment.

[0008] FIG. **3** is an exploded perspective view of the first embodiment.

[0009] FIG. **4** is a top plan view of the first embodiment with the housing removed.

[0010] FIG. **5** is a sectional view taken on line **5-5** of FIG. **1**.

[0011] FIG. **6** is similar to FIG. **4** with the inner sleeve, mounting arms and cap removed.

[0012] FIG. **7** is a sectional view taken on line **7-7** of FIG. **5**.

[0013] FIG. **8** is a sectional view taken on line **8-8** of FIG. **7**.

[0014] FIG. **9** is a sectional view taken on line **9-9** of FIG. **7**.

[0015] FIG. **10** is a perspective view showing the top of a second embodiment of the toothbrush of the present invention.

[0016] FIG. **11** is an exploded perspective view of the second embodiment.

[0017] FIG. **12** is a top plan view of the second embodiment with the housing removed.

[0018] FIG. **13** is a sectional view taken on line **13-13** of FIG. **10**.

[0019] FIG. **14** is similar to FIG. **12** without the inner sleeve, brushes and cap.

[0020] FIG. **15** is a sectional view taken on line **15-15** of FIG. **12** and shows the toothbrush in a neutral or centered position.

[0021] FIG. **16** is similar to FIG. **15** and shows the rotation of the brush heads about the longitudinal axis in one direction.

[0022] FIG. **17** is similar to FIG. **16** and shows the rotation of the brush heads in the opposite direction of that shown in FIG. **16**.

[0023] FIG. **18** is a perspective view showing the top of a third embodiment of the toothbrush of the present invention.

[0024] FIG. **19** is an exploded perspective view of the third embodiment.

[0025] FIG. **20** is a top plan view of the third embodiment with the housing removed.

[0026] FIG. **21** is a sectional view taken on line **21-21** of FIG. **18**.

[0027] FIG. **22** is similar to FIG. **20** without the inner sleeve and brushes.

[0028] FIG. **23** is a sectional view taken on line **23-23** of FIG. **20**.

[0029] FIG. **24** is a sectional view taken on line **24-24** of FIG. **21**.

[0030] FIG. **25** is a sectional view taken on line **25-25** of FIG. **21** and shows the brush heads rotating about the longitudinal axis in a first direction.

[0031] FIG. **26** is similar to FIG. **25** and shows the brush heads rotating about the longitudinal axis in a direction opposite that shown in FIG. **25**.

DETAILED DESCRIPTION OF THE INVENTION

[0032] A first embodiment of the brush head assembly of the present invention is shown generally at **100** in FIGS. **1-3**; a second embodiment of the brush head assembly of the present invention generally at **200** in FIGS. **10-11**; and a third embodiment is shown generally at **300** in FIGS. **18-19**. Each of assemblies **100**, **200** and **300** is part of an electric toothbrush which is removably connected to an electrically powered power handle which provides reciprocating oscillating motion along a longitudinal axis of the power handle for driving an oscillating mechanism of the brush head assembly. This reciprocating oscillating motion along the longitudinal axis is translated by the respective assembly to provide oscillating movement of the twin brush heads thereof about a longitudinal axis of the assembly.

[0033] Referring to FIGS. **1-3**, assembly **100** has a rear end **102** and a front end **104** which define therebetween the longitudinal direction of the assembly. Assembly **100** also has first and second sides **106** and **108** defining therebetween a lateral direction of the assembly. Assembly **100** has a top **110** and a bottom **112** defining therebetween a vertical direction. Rear end **102** is configured to connect to an electric toothbrush power handle (not shown).

[0034] Assembly **100** includes a housing **114** which includes an outer sleeve **116** having a substantially circular cross section, a neck **118** connected thereto and flaring outwardly into an oval-shaped cross section and a cover **120** connected to neck **118**. Housing **114** further includes a cap **122** which is connected to cover **120** and a lower portion of neck **118**.

[0035] Referring to FIGS. **3-6**, assembly **100** further includes a linear oscillator **124** and a rotational oscillator **126** which is rotatably mounted on oscillator **124**. Linear

oscillator **124** includes a power-handle engaging portion **128** that includes a post **130** for removably engaging the power handle of the electric toothbrush. A rod **132** is rigidly mounted on and extends forward from portion **128**. An actuator **134** is rigidly mounted on rod **132**. Actuator **134** includes first and second arms **136** and **138** which extend laterally outwardly in opposite directions from one another and from their connection to rod **132**. First arm **136** includes a first lateral projection **140** and second arm **138** includes a second lateral projection **142** which projects laterally opposite from projection **140**. A first forward projection **144** extends forward from first lateral projection **140** and a second forward projection **146** extends forward from second lateral projection **142**. A third lateral projection **148** extends laterally outwardly from first forward projection **144** and away from second arm **138** and is positioned forward of first lateral projection **140**.

[0036] Referring to FIGS. **3-5**, rotational oscillator **126** includes an inner sleeve **150**, first and second mounting arms **152** and **154** which extend radially outwardly from sleeve **150** laterally opposite one another, and a brush comprising first and second brush heads **156** and **158** rigidly mounted respectively on arms **152** and **154**. First brush head **156** includes a first pad **160** and a first set **162** of flexible bristles which angle downwardly and laterally inwardly therefrom. Second brush head **158** includes a second pad **164** and a second set **166** of flexible bristles which extend downwardly and laterally inwardly therefrom. Pads **160** and **164** are substantially perpendicular to one another so that first set **162** of bristles extends substantially perpendicular to second set **166** of bristles. The free ends of the bristles of first set **162** and second set **166** define therebetween a tooth-receiving space **168** (FIG. **7**) for receiving the teeth during the brushing thereof. As shown in FIG. **5**, inner sleeve **150** defines a longitudinally extending bore **170** which slidably receives rod **132** therein. More particularly, linear oscillator **124** is linearly slidable in an oscillating manner back and forth as indicated at arrow A in FIG. **5** along a longitudinally extending axis X. Inner sleeve **150** is rotatably disposed within interior chamber **117** of housing **114** so that rotational oscillator **126** rotates about axis X as shown by arrow B in FIG. **4** in response to the linear oscillation of oscillator **124**.

[0037] More particularly and with reference to FIGS. **6-9**, first and second triangular cams **172** and **174** are mounted respectively atop first and second pads **160** and **164**. As shown in FIG. **9**, first cam **172** has a camming surface **176** which tapers or angles radially inwardly relative to axis X in a longitudinal direction from the rear end of cam **172** to the front end of cam **172**. As shown in FIG. **8**, second cam **174** has a second camming surface **178** which tapers or angles radially inwardly relative to axis X in the longitudinal direction from a front end of cam **174** to a rear end of cam **174**. Thus, camming surfaces **176** and **178** angle generally in opposite directions to one another.

[0038] Thus, referring to FIG. **8**, when linear oscillator **124** moves longitudinally forward as indicated at arrow C, second forward projection **146** slidably engages second camming surface **178** to force second brush head **158** away from cover **120** as indicated at arrow D and first brush head **156** toward cover **120** as indicated at arrow E. Stated otherwise, the forward motion of linear oscillator **124** causes rotational oscillator **126** to rotate about axis X in a first direction. Referring to FIG. **9**, the movement of linear oscillator **124** in the rearward direction as indicated at arrow F causes third lateral projection **148** to slidably engage first camming surface **176** to force first head **156** away from cover **120** as indicated at arrow G and section brush head **158** toward cover **120** as indicated at arrow H. Thus, the rearward movement of linear oscillator **124** causes rotational oscillator **126** to rotate about axis X in a second direction opposite that of the first direction shown in FIG. **8**.

[0039] Brush head assembly **200** is now described referring to FIGS. **10-11**. Assembly **200** includes a housing **214** which is very similar to housing **114** except that it includes a cover **220** which has a shape which is slightly different than that of cover **120**. In addition, assembly **200** includes a linear oscillator **224** and a rotational oscillator **225** having configurations which differ from the corresponding structures of assembly **100**. Assembly **200** further includes an actuator **234** having a configuration different than that of actuator **134**. Referring to FIGS. **12**, **14** and **15**, rod **232** includes an angled segment **226** adjacent its free front end. Segment **226** has first and second opposed camming surfaces **228** and **230**, each of which is angled or extends transversely in a lateral direction with respect to axis X.

[0040] Actuator **234** includes first and second arms **236** and **238**, each of which have a generally T-shaped configuration. Thus, first arm **236** has a first lateral projection **240** which extends laterally outwardly with respect to axis X and second arm **238** has a second lateral projection **242** which extends laterally outwardly from axis X in the opposite direction. First arm **236** includes a first cross bar **244** connected to first projection **240** and second arm **238** includes a second cross bar **246** connected to second projection **242**. Each of cross bars **244** and **246** thus provide forward and rearward projections which extend respectively forward and rearwardly of the respective projections **240** and **242**. First and second posts **248** and **250** extend downwardly from arms **236** and **238** and are spaced from one another to define there between a central space which receives therein angled segment **226** of rod **232**. Thus, posts **248** and **250** are respectively closely adjacent or in abutment with camming surfaces **228** and **230** of segment **226**.

[0041] Referring to FIG. **12**, rotational oscillator **225** includes first and second brush heads **256** and **258** which respectively include first and second pads **260** and **264** from which the respective sets of bristles extend. Front and rear guides **266** and **268** extend upwardly from first pad **260** and are longitudinally spaced from one another to define therebetween a space for receiving therein first cross bar **244**. The front and rear ends of cross bar **244** are respectively closely adjacent or in abutment with guides **266** and **268**. Similarly, second brush head **258** includes front and rear guides **270** and **272** which extend upwardly from second pad **264** and define there between a space for receiving therein second cross bar **246** in a like manner. The upper surface of first pad includes a first tapered camming surface **274** (FIG. **15**) which is disposed between front and rear end guides **266** and **268**. Likewise, the upper surface of second pad **264** includes a second tapered camming surface **276** (FIG. **15**) which is disposed between front and rear guides **270** and **272**. As seen in FIG. **15**, cross bar **244** abuts camming surface **274** and the lower surface of housing **220**. Likewise, second cross bar **246** abuts camming surface **276** and lower surface of cover **220**.

[0042] In operation, the rearward movement of linear oscillator **224** during oscillation thereof, as indicated by arrows J in FIGS. **12** and **14**, causes first camming surface

228 to slidably engage first post 248 and force actuator laterally in a first direction as indicated by arrow K in FIG. 16. This movement of actuator 234 causes cross bar 246 to slidably engage the lower surface of cover 220 and camming surface 276, thus forcing second brush head 258 away from cover 220 as indicated at arrow L in FIG. 16 and first brush head 256 toward cover 220 as indicated at arrow M in FIG. 16, thus producing a rotational movement of rotational oscillator 225 about axis X. Conversely, the forward stroke of linear oscillator 224 as indicated by arrow N in FIGS. 12 and 14 causes camming surface 230 of segment 226 to slidably engage second post 250 so that actuator 234 moves laterally as indicated at arrow O in FIG. 17 in a direction opposite that shown at arrow K in FIG. 16. This movement of actuator 234 causes first cross bar 244 to slidably engage camming surface 274 to force first brush head 256 away from cover 220 as indicated at arrow P in FIG. 17 and second brush head 258 toward cover 220 as indicated at arrow Q in FIG. 17. Thus, the linear oscillation of oscillator 224 is translated into the rotational movement of oscillator 225, including the rotational movement of brushes 256 and 258.

[0043] Brush head assembly 300 is now described with reference to FIGS. 18-20. Assembly 300 includes a housing 302 which is similar to the housing of the previous embodiments except that it has a cover 304 which has a slightly varied configuration. Assembly 300 further includes an actuator 310 and a pivoting member 312. A linear oscillator 306 includes a rod 314 which extends primarily longitudinally and includes an angled segment 316 which extends transversely to longitudinal axis X. Angled segment 316 includes a free end adjacent which it is pivotally connected to pivoting member 312 via a first pivot 318, which is laterally offset from axis X. More particularly, a socket 317 is connected to angled segment 316 and receives therein pivot 318 (FIGS. 22-23).

[0044] Pivoting member 312 has a body in the form of a substantially flat triangular plate. Pivot 318 extends downwardly from adjacent one corner of the triangular body. Member 312 is pivotally connected to cover 304 via a second pivot 320 which extends upwardly from the body of member 312 to cover 304. Second pivot 320 is laterally offset from axis X opposite first pivot 318 and is disposed adjacent a second corner of the triangular plate of member 312. A third pivot 322 extends downwardly from the body of pivoting member 312 adjacent the forward corner thereof.

[0045] Actuator 310 includes a central portion 324 defining a central opening 326 which is elongated in the longitudinal direction and which lies on axis X when actuator 310 is in a neutral centered position. Opening 326 receives therein third pivot 322 to provide a pivotal and sliding connection therebetween. Opening 326 is slightly wider than pivot 322 in the lateral direction and longer than pivot 322 in the longitudinal direction to allow for sliding movement between pivoting member 312 and pivot 322. Actuator 310 includes a first arm having a first lateral projection 328 and a second arm having a second lateral projection 330 wherein projections 328 and 330 extend laterally from central portion 324. A first cross bar 332 is connected to first projection 328 and a second cross bar 334 is connected to projection 330 so that the arms are generally T-shaped.

[0046] Rotational oscillator 306 includes first and second brush heads 336 and 338. First brush head 336 includes a first pad 340 from which the respective set of bristles extends and second brush head 338 includes a second pad 342 from which the respective set of bristles extends. Front and rear guides 344 and 346 extend upwardly from first pad 340 and are longitudinally spaced to define therebetween a space in which is received first cross bar 332 of actuator 310. Likewise, front and rear guides 348 and 350 extend upwardly from second pad 342 and are longitudinally spaced to define therebetween a space for receiving therein second cross bar 334. The upper surface of first pad 340 includes a first camming surface 352 (FIGS. 25-26) disposed between front and rear guides 344 and 346. Likewise, the upper surface of second pad 342 includes a second camming surface 354 (FIGS. 25-26) disposed between front and rear guides 348 and 350.

[0047] In operation, linear oscillator 306 oscillates linearly in the longitudinal direction as indicated at arrow A in FIG. 21 to cause rotational oscillator 308 to rotatably oscillate as indicated at arrow B in FIG. 20. More particularly, the linear oscillation of oscillator 306 causes pivoting member 312 to pivot about second pivot 320 via the pivotal connection between oscillator 306 and pivoting member 312 via first pivot 318. Thus, member 312 oscillates in a pivotal manner about second pivot 320 as indicated by arrow R in FIG. 22. This pivoting motion of member 312 causes third pivot 322 to oscillate laterally back and forth to alternately slidably engage opposed portions of central portion 324 which bound opening 326 in order to drive actuator 310 laterally back and forth. The cross bars of actuator 310 then engage the camming surfaces of the pads of the brush heads to cause rotation of rotational oscillator 308. More particularly, when linear oscillator 306 is moved in a forward direction as indicated at arrow S in FIGS. 20 and 22, the pivotal motion of pivoting member 312 causes pivot 322 and actuator 310 to move laterally as indicated at arrow T in FIG. 25 so that second cross bar 334 slidably engages the inner surface of cover 304 and second camming surface 354 to force second brush head 338 away from cover 304 as indicated at arrow U and first brush head 336 toward cover 304 at indicated at arrow V. On the backstroke of the oscillation of linear oscillator 306 as indicated at arrow W in FIGS. 20 and 22, pivoting member 312 pivots the other way so that third pivot 322 and actuator 310 move laterally in the opposite direction as indicated at arrow Y in FIG. 26. This lateral movement of actuator 310 causes first cross bar 332 to slidably engage the inner surface of cover 304 and first camming surface 352 to force first brush head 336 away from cover 304 as indicated at arrow Z and second brush head 338 toward cover 304 as indicated at arrow AA in FIG. 26.

[0048] Thus, each of brush head assemblies 100, 200 and 300 provides a simple and effective mechanism for translating longitudinal reciprocal oscillating movement of a linear actuator into rotational oscillating movement of twin brush heads in order to achieve an effective brushing motion for cleaning teeth.

[0049] In the foregoing description, certain terms have been used for brevity, clearness, and understanding. No unnecessary limitations are to be implied therefrom beyond the requirement of the prior art because such terms are used for descriptive purposes and are intended to be broadly construed.

[0050] Moreover, the description and illustration of the invention is an example and the invention is not limited to the exact details shown or described.

1. A toothbrush head assembly for use with an electric toothbrush power handle, the assembly comprising:

a housing having a longitudinal direction;

an oscillating member which is disposed in the housing and which oscillates reciprocally in the longitudinal direction; and

a brush which is mounted on the housing and which oscillates rotatably about a longitudinally extending axis.

2. The assembly of claim **1** further comprising at least one camming surface for facilitating translation of reciprocal motion of the oscillating member into rotational motion of the brush.

3. The assembly of claim **2** further comprising an actuator which moves transversely to the longitudinal direction in response to movement of the oscillating member.

4. The assembly of claim **3** wherein the actuator is disposed between the brush and the housing.

5. The assembly of claim **4** wherein the at least one camming surface is carried by one of the housing, the brush and the actuator.

6. The assembly of claim **2** wherein the oscillating member comprises a rod and a pair of arms connected to and extending outwardly from the rod and movable therewith.

7. The assembly of claim **6** wherein the brush comprises first and second brush heads; and the arms are disposed respectively adjacent the two brush heads.

8. The assembly of claim **7** wherein the at least one camming surface includes first and second camming surfaces; and the arms respectively slidably engage the first and second camming surfaces during longitudinal movement of the arms.

9. The assembly of claim **1** wherein the oscillating member comprises first and second camming surfaces.

10. The assembly of claim **9** further comprising an actuator engageable with the first and second camming surfaces; and wherein the actuator is movable transversely to the longitudinal axis in response to oscillation of the oscillating member.

11. The assembly of claim **10** wherein the actuator engages the brush.

12. The assembly of claim **11** further comprising a third camming surface which the actuator slidably engages.

13. The assembly of claim **12** further comprising a cover which is adjacent the brush and which the actuator slidably engages.

14. The assembly of claim **1** further comprising a pivoting member pivotally connected to the oscillating member.

15. The assembly of claim **14** further comprising an actuator movably connected to the pivoting member and movable transversely to the longitudinal direction.

16. The assembly of claim **15** wherein the actuator engages the brush.

17. The assembly of claim **15** wherein one of the actuator and the pivoting member defines an elongated opening; and further comprising a pivot carried by the other of the actuator and the pivoting member and disposed in the elongated opening.

18. The assembly of claim **14** further comprising first and second pivots; wherein the pivoting member is pivotally connected to the oscillating member via the first pivot and pivotally connected to the housing via the second pivot.

19. The assembly of claim **18** further comprising a third pivot and an actuator pivotally connected to the pivoting member via the third pivot.

20. The assembly of claim **1** wherein the housing has a front and a rear defining therebetween the longitudinal direction; and the brush comprises first and second brush heads; and further comprising:

a cover disposed adjacent the brush heads;

a first camming surface disposed between the first brush head and the cover; and

a second camming surface disposed between the second brush head and the cover;

wherein the first camming surface tapers forward and radially inwardly toward the axis; and the second camming surface tapers rearward and radially inwardly toward the axis.

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