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(54) **SELF-POWERED MANUAL TOOTHBRUSH WITH SENSORS**

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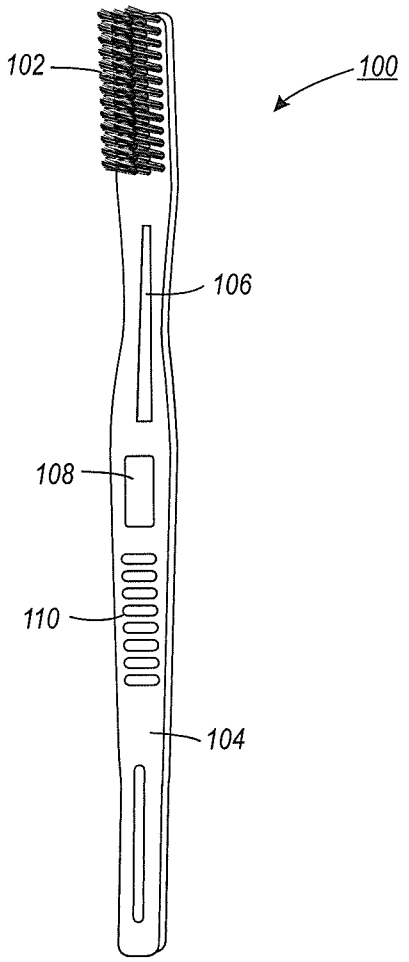
USPC **15/167.1**

(57) **ABSTRACT**

A toothbrush assembly can include a plurality of bristles and a toothbrush body. The toothbrush body can include an indicator to provide information to a user using the toothbrush during a teeth cleaning session. A sensing mechanism can include at least one electroded sheet and provide an electric signal to the indicator responsive to the user using the toothbrush assembly during the teeth cleaning session.



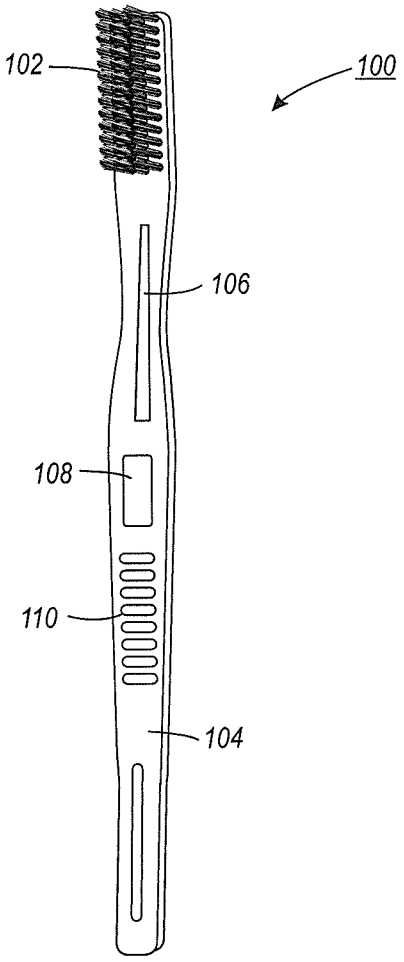


FIG. 1

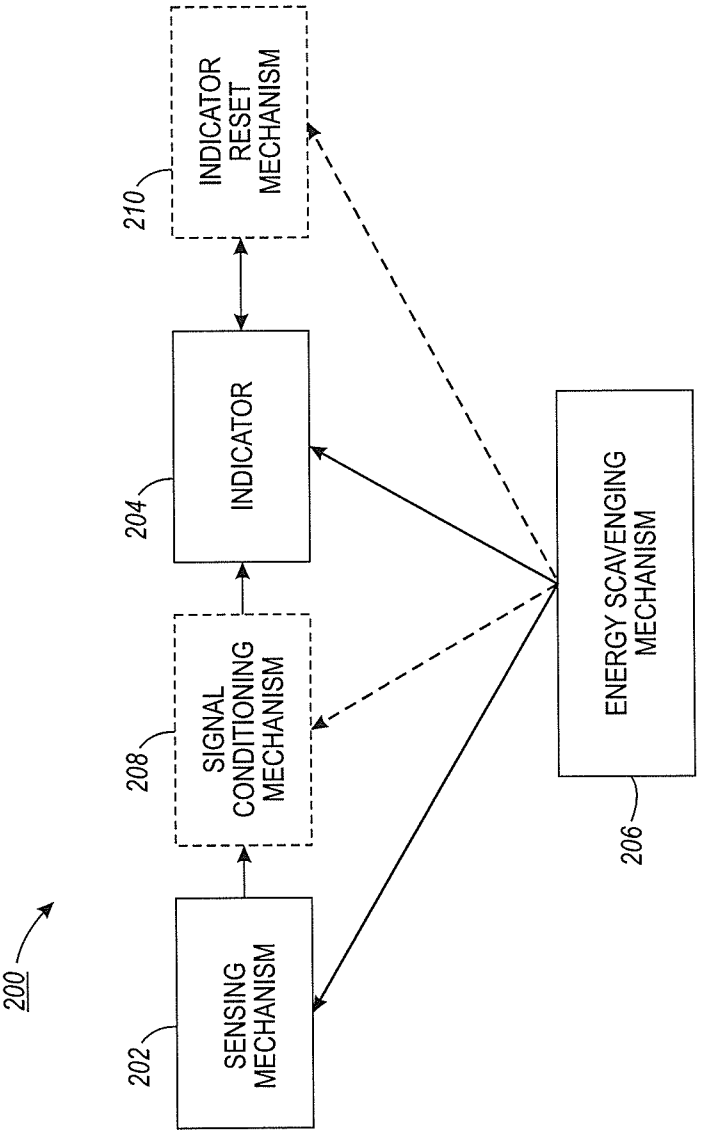

200
SENSING MECHANISM
202
SIGNAL CONDITIONING MECHANISM
208
INDICATOR
204
INDICATOR RESET MECHANISM
210
ENERGY SCAVENGING MECHANISM
206

FIG. 2

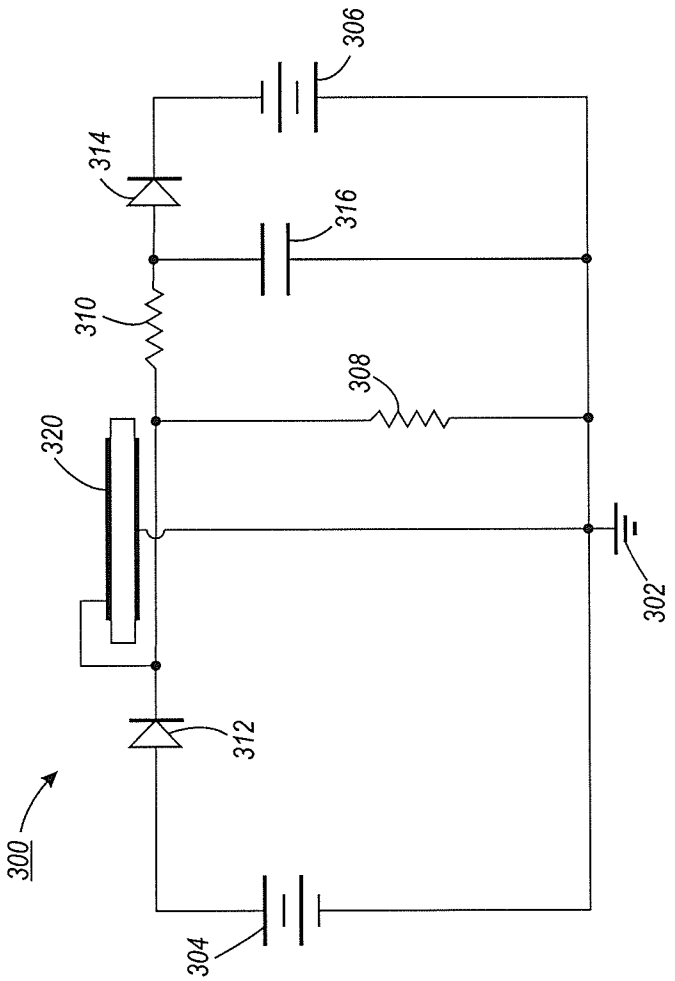


FIG. 3

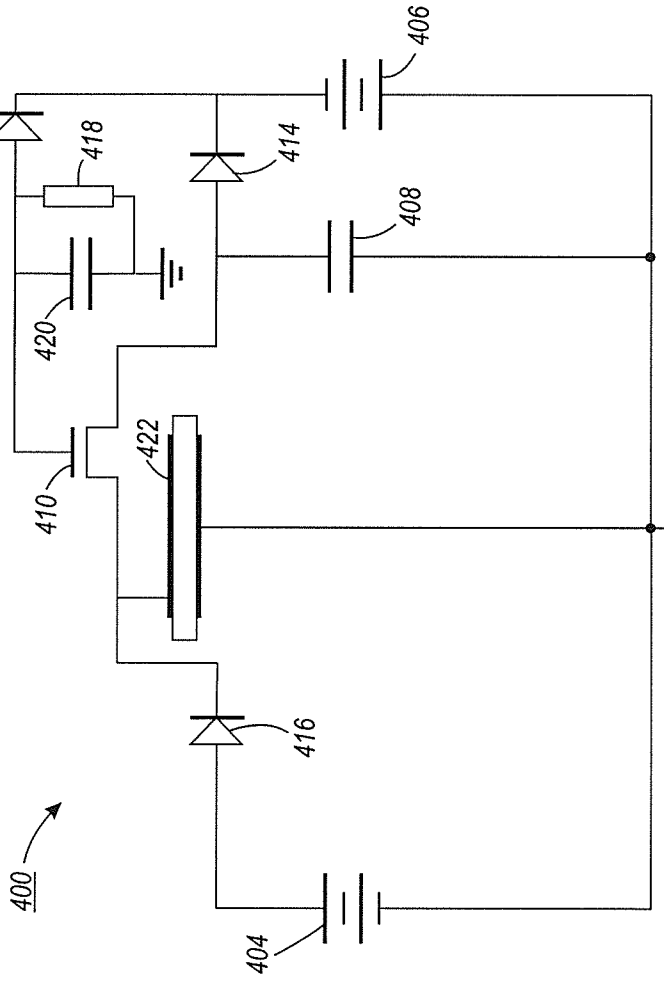


FIG. 4

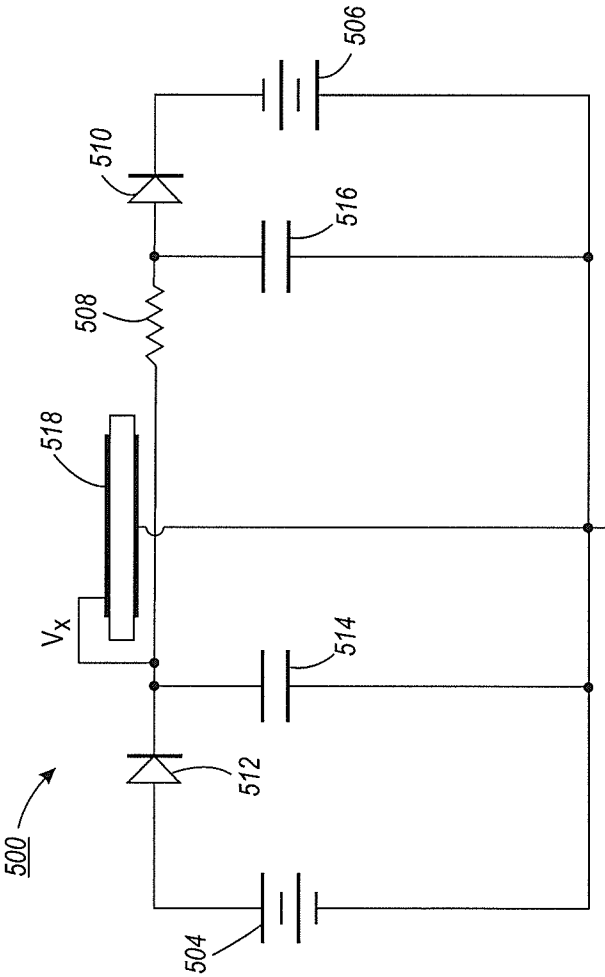


FIG. 5

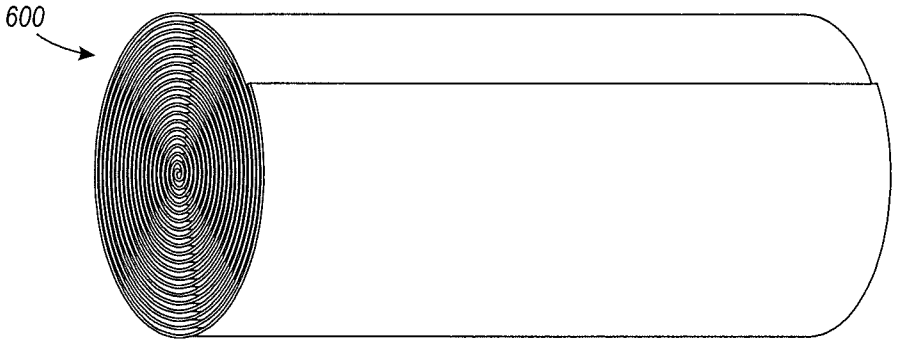


FIG. 6

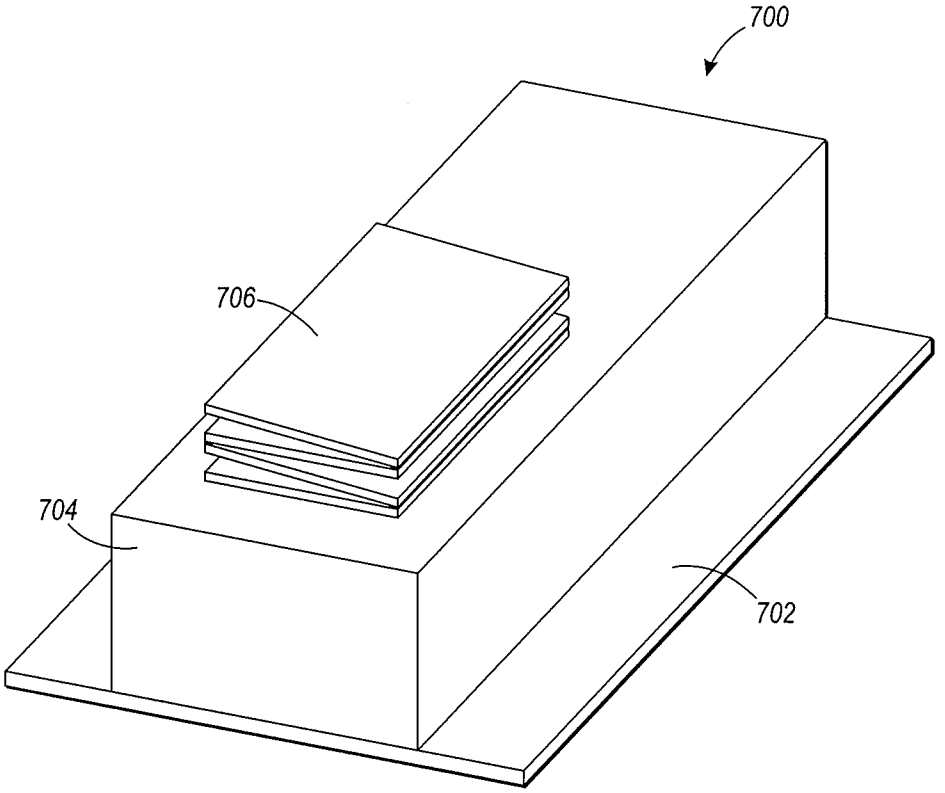


FIG. 7

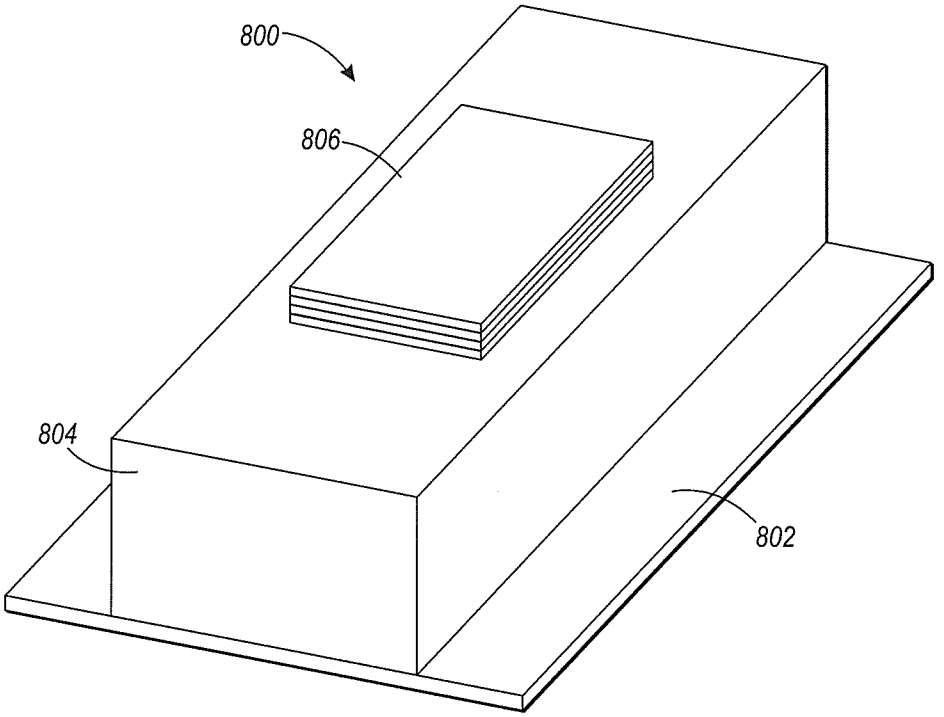


FIG. 8

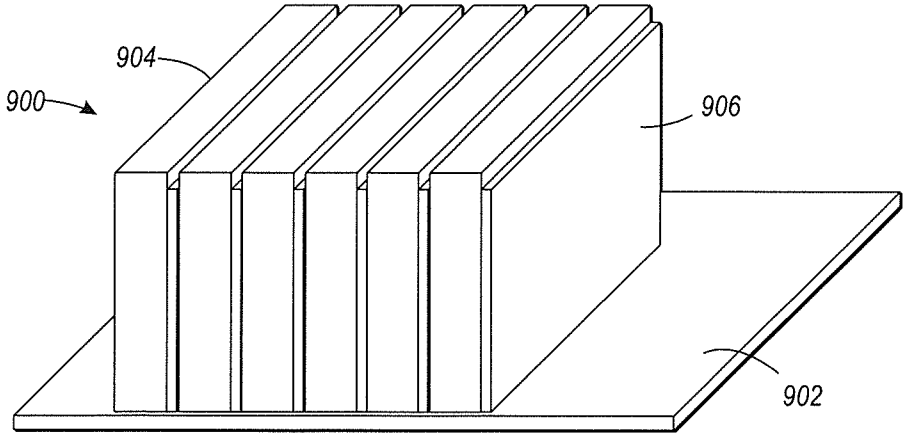


FIG. 9

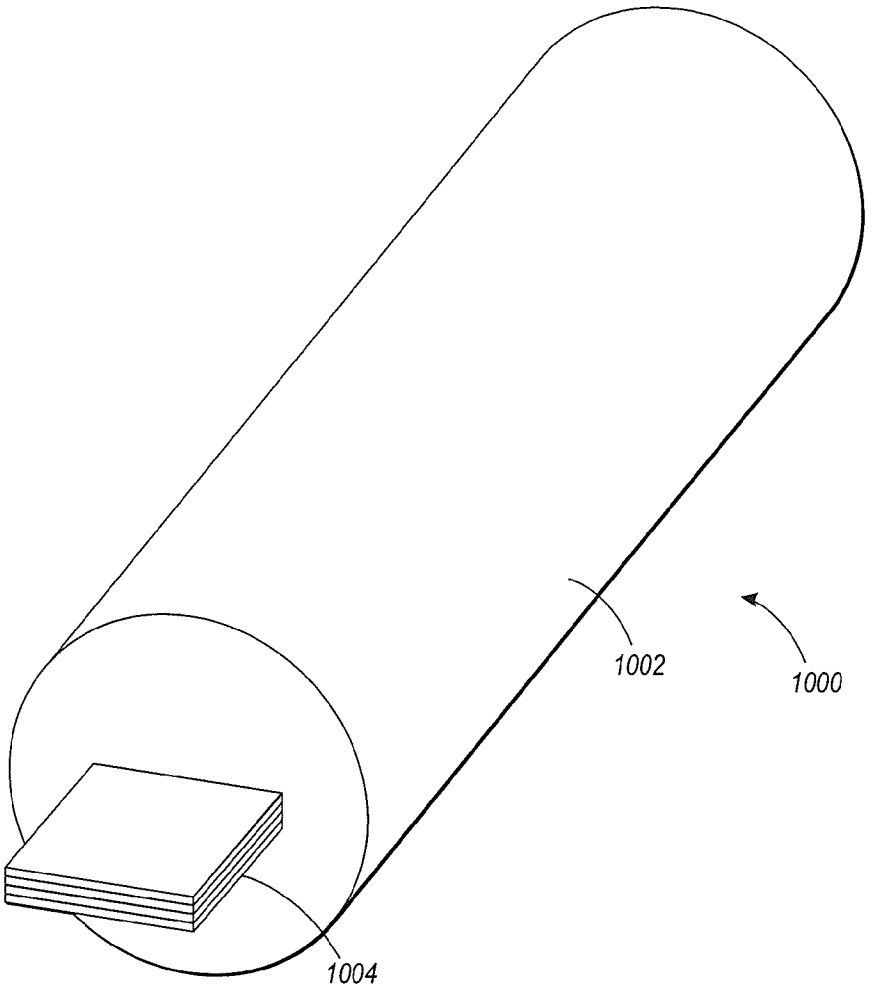


FIG. 10

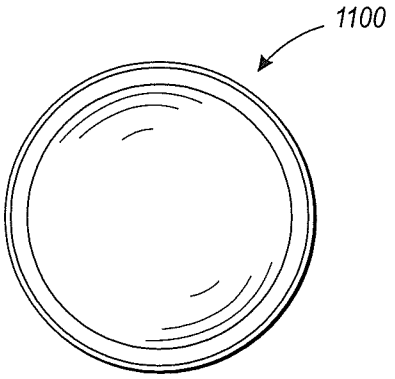


FIG. 11A

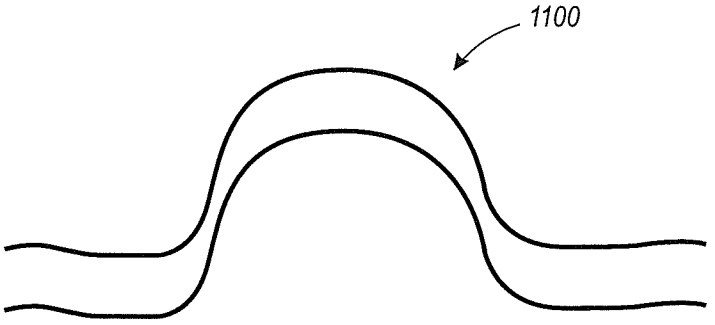


FIG. 11B

SELF-POWERED MANUAL TOOTHBRUSH WITH SENSORS

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is a continuation-in-part of U.S. patent application Ser. No. 13/420,488, filed Mar. 14, 2012 and titled SELF-POWERED MANUAL TOOTHBRUSH WITH SENSORS, which is fully incorporated by reference herein.

TECHNICAL FIELD

[0002] The disclosed technology relates to the field of toothbrush devices, and more particularly to self-powered manual toothbrushes having at least one sensing mechanism and an indicator such as a display device.

BACKGROUND

[0003] Despite many notable advances in toothbrush technologies over the years, current toothbrushes continue to have a number of shortcomings. For example, while certain electric-powered toothbrushes, e.g., the Oral-B 1000 Professional Care 1000 Electric Toothbrush, may sense pressure being applied thereto during brushing, such devices merely determine whether the pressure is excessive and, if so, shut off the electric drive to the bristles to prevent tooth damage.

[0004] Other electric toothbrushes, e.g., the Oral-B Triumph with SmartGuide Professional Care 9910 Electric Toothbrush, may provide a visual indication of the time spent brushing but such brushes require powered rotating bristles and thus tend to be rather expensive, e.g., upwards of $100.00 to $200.00.

[0005] Further, current manual toothbrushes do not provide users with any type of feedback as to how long brushing has occurred or how well the brushing has been done by the user.

[0006] Accordingly, there remains a need for improved toothbrushes and toothbrush assemblies.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. **1** illustrates an example of a toothbrush assembly in accordance with certain embodiments of the disclosed technology.

[0008] FIG. **2** is a functional block diagram illustrating an example of a toothbrush assembly in accordance with certain embodiments of the disclosed technology.

[0009] FIG. **3** is a schematic diagram illustrating a first example of toothbrush assembly circuitry in accordance with certain embodiments of the disclosed technology.

[0010] FIG. **4** is a schematic diagram illustrating a second example of toothbrush assembly circuitry in accordance with certain embodiments of the disclosed technology.

[0011] FIG. **5** is a schematic diagram illustrating a third example of toothbrush assembly circuitry in accordance with certain embodiments of the disclosed technology.

[0012] FIG. **6** illustrates a first example of a sensor assembly suitable for use with a toothbrush assembly, such as that illustrated by FIG. **1**, in accordance with certain embodiments of the disclosed technology.

[0013] FIG. **7** illustrates a second example of a sensor assembly suitable for use with a toothbrush assembly, such as that illustrated by FIG. **1**, in accordance with certain embodiments of the disclosed technology.

[0014] FIG. **8** illustrates a third example of a sensor assembly suitable for use with a toothbrush assembly, such as that illustrated by FIG. **1**, in accordance with certain embodiments of the disclosed technology.

[0015] FIG. **9** illustrates a fourth example of a sensor assembly suitable for use with a toothbrush assembly, such as that illustrated by FIG. **1**, in accordance with certain embodiments of the disclosed technology.

[0016] FIG. **10** illustrates a fifth example of a sensor assembly suitable for use with a toothbrush assembly, such as that illustrated by FIG. **1**, in accordance with certain embodiments of the disclosed technology.

[0017] FIGS. **11**A and **11**B together illustrate a sixth example of a sensor assembly suitable for use with a toothbrush assembly, such as that illustrated by FIG. **1**, in accordance with certain embodiments of the disclosed technology.

DETAILED DESCRIPTION

[0018] Embodiments of the disclosed technology generally include an indicator that is capable of resetting its state with time combined with the use of pressure-sensing and/or motion-sensing mechanisms and an energy scavenging mechanism to enable a manual toothbrush to provide a user with certain information such as a visual and/or audible indication that "correct" toothbrushing is either occurring or has been completed, for example. The information may be based on electric signals that, during a teeth cleaning session, may be generated by any of a number of mechanisms such as an energy scavenging mechanism that relies on the motion or flexing of the toothbrush itself

[0019] In certain embodiments, the electrical signals may be generated from piezoelectric sensors attached to or embedded in the toothbrush body itself, e.g., in the neck region, where the most flexing typically occurs during a teeth cleaning session. Alternatively, the sensors may be fabricated into the bristles themselves as the bristles tend to flex more than any other part of the toothbrush during a teeth cleaning session. The sensors may have any of a number of arrangements, geometries, and orientations as described below with specific regard to the examples illustrated by FIGS. **6-11**.

[0020] The pressure of the toothbrush bristles against the user's teeth generally causes the neck of the toothbrush body to flex slightly, creating a transient voltage on the piezoelectric element or elements. Such a voltage transient may be fed to a circuit comprising a variety of active and passive components. This circuit may transform the transient voltages into a useful measure of toothbrush use by way of a simple counting of the voltage transients or an integration of counts and/or total current generated over the time taken to complete the brushing exercise, for example.

[0021] In other embodiments, the electrical signals may be generated from a kinetic energy source such as a coil in which a magnet is free to move. In such embodiments, the coil/magnet combination may be embedded within the toothbrush itself and may be aligned to only generate sufficient electrical current when the brush movement is in a certain direction, e.g., perpendicular to the toothbrush axis. The signals indicating correct brushing motions would be fed to a circuit similar to that described above and used to indicate progress in and/or completion of the brushing activity.

[0022] The indicator may progressively provide a visual and/or audible indication of either a certain threshold or endpoint, e.g., the number and/or direction of brush strokes, being met or exceeded or a series of intermediate criteria

being met, e.g. by way of a multi-element electrophoretic display such as a segmented bar that can be activated segment-by-segment as the number of brush strokes passes certain predetermined values. For example, a ten-element linear bar may be implemented such that the cumulative transient count increments each segment of the linear bar as the number of counts exceeds multiples of ten.

[0023] In certain embodiments, the circuit and/or indicator may be reset to their prior, e.g., original, state by way of a delay circuit or by a manual reset switch fabricated as part of the circuit, for example. This may be advantageous in embodiments where the indicator only needs to display for a short time, for example.

[0024] Direct printing of circuit elements and/or other pertinent components into or onto certain portions or parts of a toothbrush assembly may facilitate low manufacturing costs and, thus, low retail prices of the toothbrush assembly. This may essentially result in the establishment of a new product category that fits well between manual toothbrushes and electric toothbrushes, in terms of both price and functionality. This is particularly desirable for manual toothbrushes, which are typically used by a user for only a month or so and then discarded.

[0025] Direct printing of components may also facilitate low-to-very low power consumption by the toothbrush assembly as a whole or any of the individual components. Alternatively, fabrication of conventional silicon circuits and subsequent embedding in or attachment to the toothbrush body may be used.

[0026] FIG. **1** illustrates an example of a toothbrush assembly **100** in accordance with certain embodiments of the disclosed technology. In the example, the toothbrush assembly **100** includes a plurality of bristles **102** and a toothbrush body **104**. The plurality of bristles **102** may include any of a number of types and arrangements of standard toothbrush bristles. The toothbrush body **104** is coupled with the plurality of bristles **102**.

[0027] The toothbrush assembly **100** also includes a sensing mechanism **106** that is configured to provide an electric signal responsive to a user using the toothbrush assembly **100** during a teeth cleaning session. While the example shows the sensing mechanism **106** as being part of or incorporated with the toothbrush body **104** and fully separate from the plurality of bristles **102**, it should be noted that the sensing mechanism **106** may be located at other locations or positions with respect to the toothbrush body **104**, the plurality of bristles **102**, or both in other embodiments.

[0028] In the illustrated example, the toothbrush assembly **100** also includes circuitry **108** that is formed in connection with the toothbrush body **104**. While the circuitry **108** may be visible to a user of the toothbrush assembly **100** in certain embodiments, it may be fully encased in or enclosed by the toothbrush body **104** in other embodiments. Standard printing techniques and materials may be used to create the circuitry **108** on or within a certain portion, area, or component of the toothbrush assembly **100** that is more flexible than other portions, areas or components, for example. The circuitry **108** may include multiple sub-circuits that may be generated or formed separately from each other and subsequently combined with each other to form the circuitry **108**.

[0029] In certain embodiments, the circuitry **108** may include a small circuit fabricated by conventional lithographic techniques onto a flexible printed circuit board (PCB) that could be subsequently laminated or otherwise connected to charge generators, for example. Certain implementations of the circuitry **108** are described below with regard to FIGS. **3-5**.

[0030] The toothbrush assembly **100** of FIG. **1** also includes an indicator **110** configured to provide information to a user using the toothbrush assembly **100** during a teeth cleaning session. This information may be based at least in part on the electric signal provided by the sensing mechanism **106** to the indicator **110**. In certain embodiments, the indicator **110** may provide the information to the user dynamically.

[0031] The information provided to the user may include visual information, audible information, or both. For example, visual information may correspond to how many strokes the user has made with the toothbrush assembly **100** during the teeth cleaning session, how many additional strokes the user should make with the toothbrush assembly **100** during the teeth cleaning session, or both. Such visual information may include a number, a bar chart, a line, or any combination thereof. In certain embodiments, the indicator **110** may include a line of 4-10 individual electrophoretic, e.g. e-ink, display elements that total 1-2 inches in length.

[0032] In certain embodiments, the information provided to the user may include information pertaining to how long the user has been using the toothbrush assembly **100** during the teeth cleaning session. Alternatively or in addition thereto, the information provided to the user may include information pertaining to how much longer the user should use the toothbrush assembly **100** during the teeth cleaning session. Alternatively or in addition thereto, the information provided to the user may include information pertaining to how many strokes the user has made with the toothbrush assembly **100** during the teeth cleaning session. Alternatively or in addition thereto, the information provided to the user may include information pertaining to how many additional strokes the user should make with the toothbrush assembly **100** during the teeth cleaning session. Alternatively or in addition thereto, the information provided to the user may include information pertaining to whether the user is using the toothbrush assembly **100** properly during the particular teeth session.

[0033] The indicator **110** may include a transient display device or a persistent display device. For example, the indicator **110** may include an electrophoretic display device, an electrochromic display device, or both. In embodiments where the indicator **110** includes an electrophoretic display device, the electrophoretic display device may include a plurality of bars corresponding to a number of brush strokes the user has made or has yet to make with the toothbrush assembly **100**, for example.

[0034] In certain embodiments, the sensing mechanism **106** includes at least one piezoelectric charge generator. Alternatively or in addition thereto, the sensing mechanism **106** includes a kinetic energy assembly. Such a kinetic energy assembly may include a coil and a magnet configured to move within the coil, for example. In these embodiments, the information presented to the user by the indicator **110** may include information pertaining to whether the user is using the toothbrush assembly **100** properly during the teeth cleaning session based at least in part on movement of the magnet within the coil.

[0035] In certain embodiments, the sensing mechanism **106** may be coupled with the plurality of bristles **102**. In such embodiments, the sensing mechanism **106** may be configured to provide the electric signal to the indicator **110** responsive to an application of pressure to the sensing mechanism **106**.

[0036] In alternative embodiments, the plurality of bristles **102** may include the sensing mechanism **106**. In such embodiments, the sensing mechanism **106** may be configured to provide the electric signal to the indicator **110** responsive to an application of pressure to the plurality of bristles **102** such as would occur when the user brushes his or her teeth, thus causing his or her teeth to exert said pressure on the plurality of bristles **102**.

[0037] FIG. **2** is a functional block diagram illustrating an example of a toothbrush assembly **200** in accordance with certain embodiments of the disclosed technology. In the example, the toothbrush assembly **200** includes a sensing mechanism **202**, such as the sensing mechanism **106** of FIG. **1**.

[0038] The toothbrush assembly **200** of FIG. **2** also includes an indicator **204**, such as the indicator **110** of FIG. **1**. In certain embodiments, the indicator **204** may be configured to operate independent of any power supply external to the toothbrush assembly **200**. In such embodiments, an energy scavenging mechanism **206** may be used to provide operating power to the indicator **204** responsive to the user using the toothbrush assembly **200** during a teeth cleaning session.

[0039] The energy scavenging mechanism **206** may be attached to or embedded in a portion or area of the toothbrush assembly **200** that is responsive to the movement and/or pressure generated during a teeth cleaning session. In certain embodiments, the sensing mechanism **202** may include the energy scavenging mechanism **206**. The energy scavenging mechanism may be embedded within the toothbrush body of the toothbrush assembly **200**.

[0040] In certain embodiments, the energy scavenging mechanism **206** may include at least one strip of polyvinylidene fluoride (PVDF) or polymer alternative, e.g., polyvinylidene fluoride trifluoroethylene (PVDF-TrFE), configured to generate an electric charge responsive to movement of the toothbrush assembly **200**. The one or more strips of PVDF may be printed on, embedded in, or laminated to a portion, area, or component of the toothbrush assembly **200** that flexes during a teeth cleaning session, for example. Alternatively or in addition thereto, the energy scavenging mechanism **206** may include a photovoltaic (PV) component. In certain embodiments including a piezoelectric charge generator, for example, a PV component may be used to provide switching current if the piezoelectric element is unable to provide enough operating power for the indicator **204**. In such embodiments, the piezoelectric may be used solely as a sensing device.

[0041] In certain embodiments, a signal conditioning mechanism **208** may be used to condition the electric signal provided to the indicator **204** by the sensing mechanism **202**. In such embodiments, the energy scavenging mechanism **206** may be used to provide operating power to the signal conditioning mechanism **208**.

[0042] In certain embodiments, an indicator reset mechanism **210** may be used to reset the indicator **204** responsive to a termination of the teeth cleaning session. For example, the indicator reset mechanism **210** may be used to reset the state of the indicator **204** to its original value using a delay circuit, a mechanical reset mechanism, or a combination thereof. The indicator reset mechanism **210** may include a circuit formed in connection with the toothbrush body of the toothbrush assembly **200**. In these embodiments, the energy scavenging mechanism **206** may be used to provide operating power to the indicator reset mechanism **210**.

[0043] It should be noted that virtually any of the individually illustrated components of the toothbrush assembly **200** may be combined in a single physical element or combination of elements. For example, the sensing mechanism **202** and the energy scavenging mechanism **206** may be implemented as a single component or combination of components. Alternatively or in addition thereto, the indicator **204** and the indicator reset mechanism **210** may be implemented as a single component or combination of components.

[0044] It should also be noted that the illustrated connections between the energy scavenging mechanism **206** and the other components do not necessarily reflect physical connections. For example, operating power may be routed from the signal conditioning mechanism **208** to the indicator **204**, the indicator reset mechanism **210**, or both rather than via separate and direct power supplying connections between the energy scavenging mechanism **206** and either or both of the indicator **204** and indicator reset mechanism **210**.

[0045] In certain embodiments, the starting state and/or resting state calls for all elements of the indicator, e.g., display device, to be in their "off" state, e.g., as denoted by the color white or the number zero. As the user begins to brush his or her teeth, each flexing of the toothbrush, e.g., the bristles, generates an electrical charge, e.g., in piezoelectric charge generators or in a coil/magnet assembly, which may flow through one or more diodes and onto the top electrode of a display element, for example, see, e.g., FIG. **3**, which is described below.

[0046] FIG. **3** is a schematic diagram illustrating a first example of toothbrush assembly circuitry **300** in accordance with certain embodiments of the disclosed technology. In the example, the circuitry **300** includes a ground **302**, a positive charge generator **304** in series with a first diode **312**, a negative charge generator **306** in series with a second diode **314**, two resistors **308** and **310**, a capacitor **316**, and a display element **320** such as either of the indicators **110** and **204** of FIGS. **1** and **2**, respectively, for example.

[0047] In the example, the diodes **312** and **314** only allow charge movement in one direction, so the circuitry **300** essentially functions as a charge pump. Charge from the positive charge generator **304** may be fed via the first diode **312** to the display element **320**, e.g., indicator, that then changes from white to another color. For example, the first segment of the display element **320** may be green. Charge of the opposite sign from the negative charge generator **306** may be fed through the second diode **314**, stored on the capacitor **316**, and then bled through the resistor **310** to the same side of the display element. The other resistor **308** is connected directly across the display element **320** to the ground **302**.

[0048] The characteristics of the display element **320** may be such that there is hysteresis in the response to applied voltage. For example, the display element **320** may include an electrophoretic medium such as materials produced by E-ink Holdings. The values of the resistors **308** and **310** and the capacitor **316** relative to the capacitor formed by the display element **320** may determine the rate of change of the voltage across the display element **320**. As the voltage across the display element **320** slowly decays, changes sign, and then crosses a threshold for the display element **320** to change color in the opposite direction, the display element **320** may revert to its uncolored state, for example. The values of the resistors **308** and **310** and the capacitor **316** may be adjusted

during the design process to create a certain reset time. In certain embodiments, this reset time may be on the order of **30** minutes to one hour.

[0049] FIG. **4** is a schematic diagram illustrating a second example of toothbrush assembly circuitry **400** in accordance with certain embodiments of the disclosed technology. The circuitry **400** may be used, for example, in certain implementations where a display medium requires a faster rate of change in order to switch state than would be possible with a simple resistor/capacitor (R/C) combination. In the illustrated example, the circuitry **400** includes a ground **402**, a first charge source **404** such as a piezoelectric element or battery with mechanical switch in series with a diode **416**, and a second charge source **406** coupled with two diodes **412** and **414** and a first capacitor **408**.

[0050] The circuitry **400** also includes a switching component **410** such as a thin film transistor (TFT) or other switching mechanism coupled with each of the three diodes **412**, **414**, and **416**, the first capacitor **408** and a second capacitor **420**, a resistor **418** and a display element **422** such as either of the indicators **110** and **204** of FIGS. **1** and **2**, respectively, for example. The circuitry **400** of FIG. **4** may facilitate switching capability such that transitions to opposite color states are more sudden. The timing of the switching may be controlled by the combination of the second capacitor **420** and the resistor **418**, for example.

[0051] FIG. **5** is a schematic diagram illustrating a third example of toothbrush assembly circuitry **500** in accordance with certain embodiments of the disclosed technology. Such embodiments may allow for independent tailoring of the size of each of a number of multiple charge sources. In the illustrated example, the circuitry **500** includes a ground **502**, a first charge source **504** such as a piezoelectric element or battery with mechanical switch in series with a diode **512**, a second charge source **506** coupled with a diode **510** and a first capacitor **516**, and a resistor **508**. The circuitry **500** also includes a second capacitor **514** and a display element **518** such as either of the indicators **110** and **204** of FIGS. **1** and **2**, respectively, for example.

[0052] In embodiments where the values of the first and second capacitors **516** and **514** are at least substantially identical, the initial value of the display element voltage V_x will be the voltage of the first charge source **504** and the final value of the display element voltage V_x will be the difference between the voltage of the first charge source **504** and the voltage of the second charge source **506**. Eventually, when all charge has leaked away, the value of the display element voltage V_x will be zero. In these embodiments, the first and second charge sources **504** and **506** generally provide different voltage levels, e.g., different voltage amplitudes.

[0053] In embodiments where the value of the second capacitor **514** is less than the value of the first capacitor **516**, the initial value of the display element voltage V_x will be the voltage of the first charge source **504** and the final value of the display element voltage V_x will be the difference between the voltage of the first charge source **504** and the product of the voltage of the second charge source **506** and (C**1**/C**2**) where C**1** is the value of the first capacitor **516** and C**2** is the value of the second capacitor **514**. Eventually, when all charge has leaked away, the value of the display element voltage V_x will be zero. In these embodiments, the first and second charge sources **504** and **506** may provide voltage levels that are at least substantially similar to each other.

[0054] FIG. **6** illustrates a first example **600** of a sensor assembly suitable for use with a toothbrush assembly, such as that illustrated by FIG. **1**, in accordance with certain embodiments of the disclosed technology. The illustrated sensor assembly **600** may be attached to or embedded within the toothbrush body, for example. Alternatively, the sensor assembly **600** may be fabricated into the bristles of the toothbrush assembly. The illustrated sensor assembly **600** has a roll-like form and may be compresses. Alternatively or in addition thereto, the sensor assembly **600** may be laminated off-axis.

[0055] FIG. **7** illustrates a second example **700** of a sensor assembly suitable for use with a toothbrush assembly, such as that illustrated by FIG. **1**, in accordance with certain embodiments of the disclosed technology. The illustrated sensor assembly **700** may be attached to or embedded within the toothbrush body, for example, or fabricated into the bristles of the toothbrush assembly. In the example, the sensor assembly **700** includes a bending axis/plane **702** on which a spacer sheet **704** is mounted. A folded sheet of electroded sensor material **706** is attached to the top surface of the spacer sheet **704**.

[0056] FIG. **8** illustrates a third example **800** of a sensor assembly suitable for use with a toothbrush assembly, such as that illustrated by FIG. **1**, in accordance with certain embodiments of the disclosed technology. The illustrated sensor assembly **800** may be attached to or embedded within the toothbrush body, for example, or fabricated into the bristles of the toothbrush assembly. The sensor assembly **800** of FIG. **8** is similar to the sensor assembly **700** of FIG. **7** in that it has a bending axis/plane **802** on which a spacer sheet **804** is mounted. Unlike the sensor assembly **700** of FIG. **7**, however, the sensor assembly **800** of FIG. **8** has an electroded sensor sheet stack **806**.

[0057] FIG. **9** illustrates a fourth example **900** of a sensor assembly suitable for use with a toothbrush assembly, such as that illustrated by FIG. **1**, in accordance with certain embodiments of the disclosed technology. The illustrated sensor assembly **900** may be attached to or embedded within the toothbrush body, for example, or fabricated into the bristles of the toothbrush assembly. In the example, the sensor assembly **900** includes a bending axis/plane **902** on which at least one electroded sensor sheet **906** is mounted. In the case of multiple electrode sensor sheets **906**, one or more spacer sheets **904** may be mounted on the bending axis/plane **902** between the one or more electroded sensor sheets **906**. The spacer sheet(s) **904** may be harder than the sensor sheet(s) **906** and may be configured to contain an electrical contact or electrode, for example.

[0058] FIG. **10** illustrates a fifth example **1000** of a sensor assembly suitable for use with a toothbrush assembly, such as that illustrated by FIG. **1**, in accordance with certain embodiments of the disclosed technology. The illustrated sensor assembly **1000** may be attached to or embedded within the toothbrush body. In the example, the sensor assembly **1000** includes an electroded sensor sheet stack **1004** formed within or otherwise attached to or coupled with a toothbrush bristle **1002**. The stack **1004** is generally offset from a bending axis of the bristle **1002**. The stack **1004** may be planar or curved, e.g., to be a concentric quarter- or half-circle in cross-section. Different orientations of the stack **1004** relative to the base generally allow for difference directions of bending, e.g., of the bristle **1002**, to be detected by the toothbrush assembly.

[0059] FIGS. **11**A and **11**B together illustrate a sixth example **1100** of a sensor assembly suitable for use with a toothbrush assembly, such as that illustrated by FIG. **1**, in accordance with certain embodiments of the disclosed technology. Whereas FIG. **11**A is a top view of the sensor assembly **1100**, FIG. **11**B is a side view of the sensor assembly **1100**. The illustrated sensor assembly **1100** may be attached to or embedded within the toothbrush body, for example, or fabricated into the bristles of the toothbrush assembly. The sensor assembly **1100** generally includes an electroded sensor sheet stack and may have a form factor substantially similar to that of a button, e.g., such that it may be pressed to cause a corresponding signal to be sent.

[0060] It will be appreciated that various of the above-disclosed and other features and functions, or alternatives thereof, may be desirably combined into many other different systems or applications. Various presently unforeseen or unanticipated alternatives, modifications, variations, or improvements therein may be subsequently made by those skilled in the art which are also intended to be encompassed by the following claims.

What is claimed is:

1. A toothbrush assembly, comprising:

a plurality of bristles;

a toothbrush body coupled with the plurality of bristles, the toothbrush body comprising:

an indicator configured to provide information to a user using the toothbrush during a teeth cleaning session, wherein the indicator is further configured to operate independent of any power supply external to the toothbrush assembly; and

an energy scavenging mechanism configured to provide operating power to the indicator responsive to the user using the toothbrush assembly during the teeth cleaning session; and

a sensing mechanism comprising at least one electroded sensor sheet and configured to provide an electric signal to the indicator responsive to the user using the toothbrush assembly during the teeth cleaning session, wherein the information provided to the user is based at least in part on the electric signal.

2. The toothbrush assembly of claim **1**, wherein the at least one electroded sensor sheet comprises a single electroded sensor sheet that is folded and secured to and at least substantially planar with a bending plane of one of the plurality of bristles.

3. The toothbrush assembly of claim **1**, wherein the at least one electroded sensor sheet comprises an electroded sensor sheet stack that is secured to and at least substantially planar with a bending plane of one of the plurality of bristles.

4. The toothbrush assembly of claim **1**, wherein the at least one electroded sensor sheet comprises an electroded sensor sheet stack that is secured to and at least substantially perpendicular to a bending plane of one of the plurality of bristles.

5. The toothbrush assembly of claim **4**, further comprising at least one spacer sheet separating at least two sheets of the electroded sensor sheet stack.

6. The toothbrush assembly of claim **5**, further comprising a plurality of spacer sheets such that one of the plurality of spacer sheets is positioned between two sheets of the electroded sensor sheet stack.

7. The toothbrush assembly of claim **5**, further comprising a plurality of spacer sheets such that each sheet of the electroded sensor sheet stack is positioned adjacent to at least one of the plurality of spacer sheets.

8. The toothbrush assembly of claim **1**, wherein the at least one electroded sensor sheet comprises an electroded sensor sheet stack that is secured within and at least substantially planar with one of the plurality of bristles.

9. The toothbrush assembly of claim **8**, wherein the electroded sensor sheet stack has a substantially curved form factor.

10. The toothbrush assembly of claim **9**, wherein the substantially curved form factor is a concentric quarter-circle in cross-section.

11. The toothbrush assembly of claim **9**, wherein the substantially curved form factor is a concentric half-circle in cross-section.

12. The toothbrush assembly of claim **1**, wherein the at least one electroded sensor sheet comprises a plurality of electroded sensor sheet stacks that are each secured within and at least substantially planar with one of the plurality of bristles.

13. The toothbrush assembly of claim **1**, wherein the at least one electroded sensor sheet has a button-like form factor.

14. The toothbrush assembly of claim **13**, wherein the at least one electroded sensor sheet is configured to respond to pressure applied thereto.

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