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Curley

(54) **NUTATING MASSAGE DEVICE**

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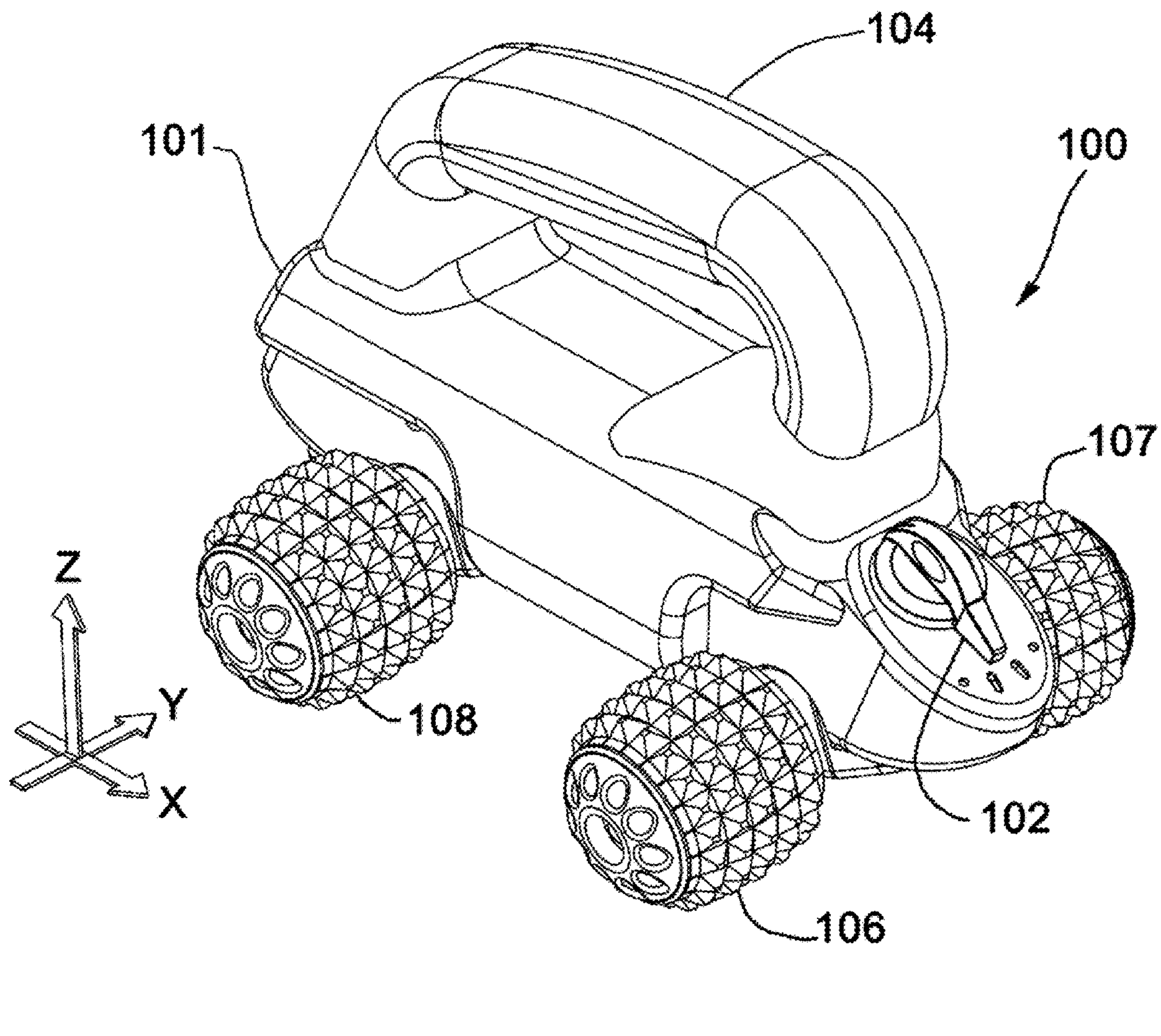
(57) **ABSTRACT**

A handheld, motorized massage device includes four rollers having stimulating projections which each rotate upon motor-driven nutating axles to produce massage contact forces that pulsate bidirectionally along three orthogonal axes. Simultaneously, opposing pairs of nutating rollers counter rotate to produce alternating stretching and compression forces along the massage-receiving fascia surface. The nutating device combines the deep fascia benefits of percussive massage devices with the superficial fascia stretching benefits of rolling massage devices.



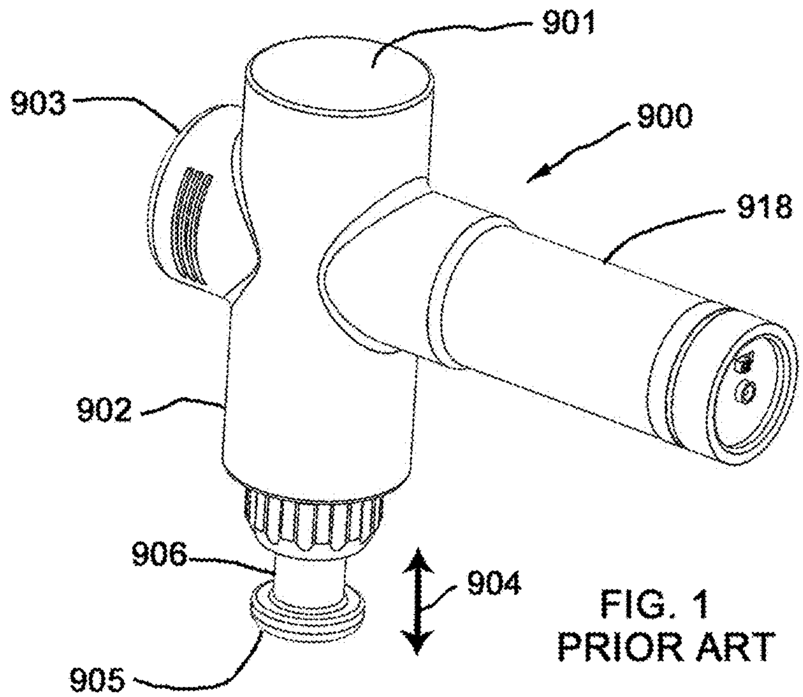


FIG. 1
PRIOR ART

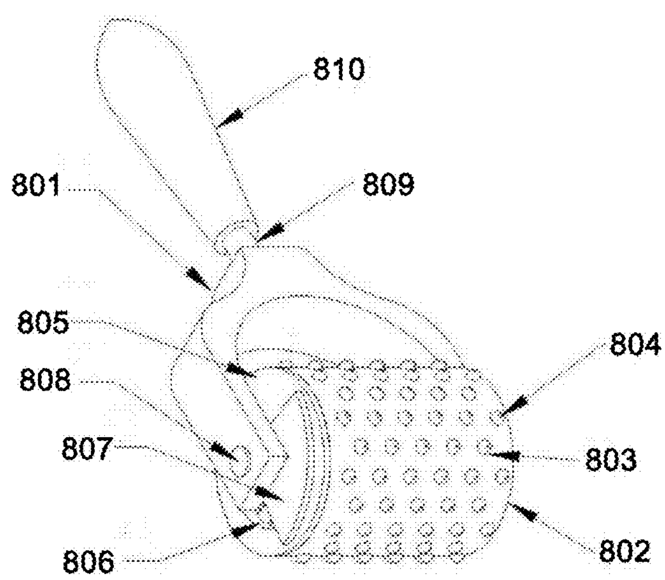


FIG. 2
PRIOR ART

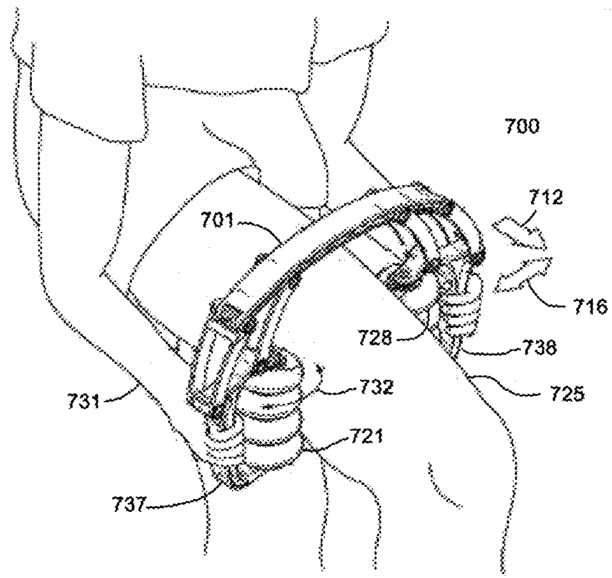


FIG. 3
PRIOR ART

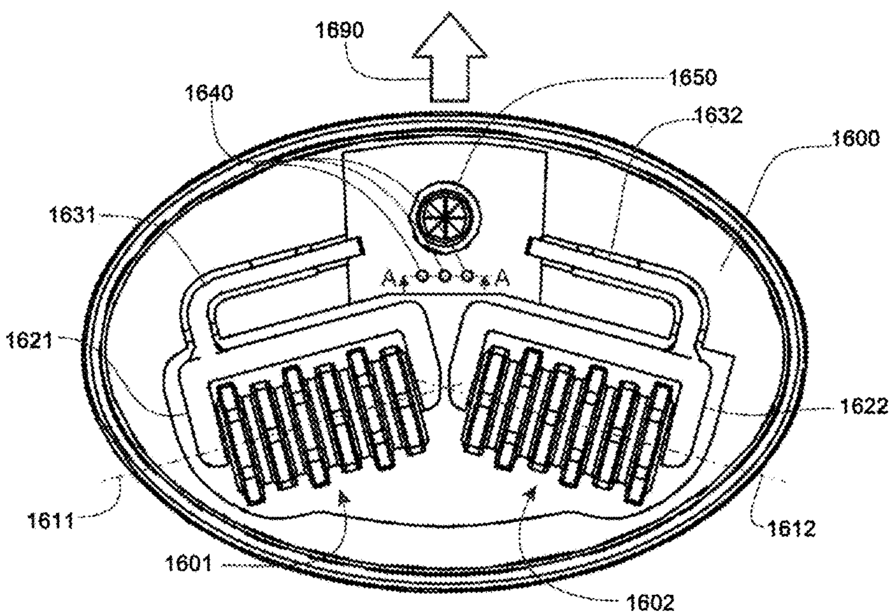
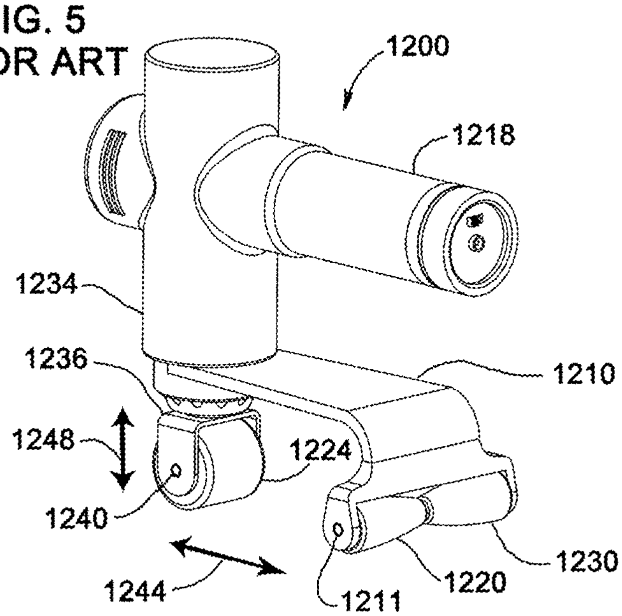


FIG. 4
PRIOR ART

FIG. 5
PRIOR ART



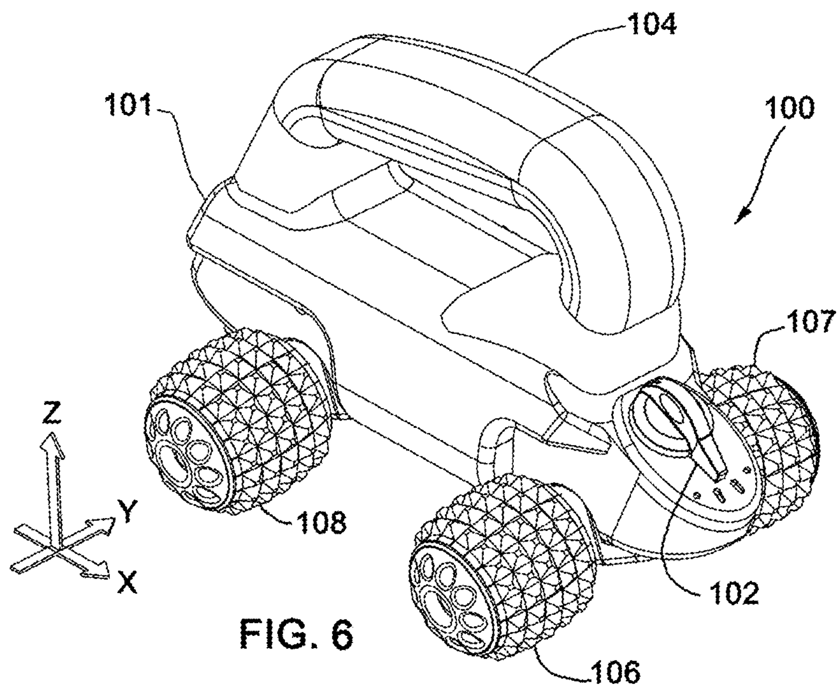

104
101
100
107
Z
Y
X
108
102
106

FIG. 6

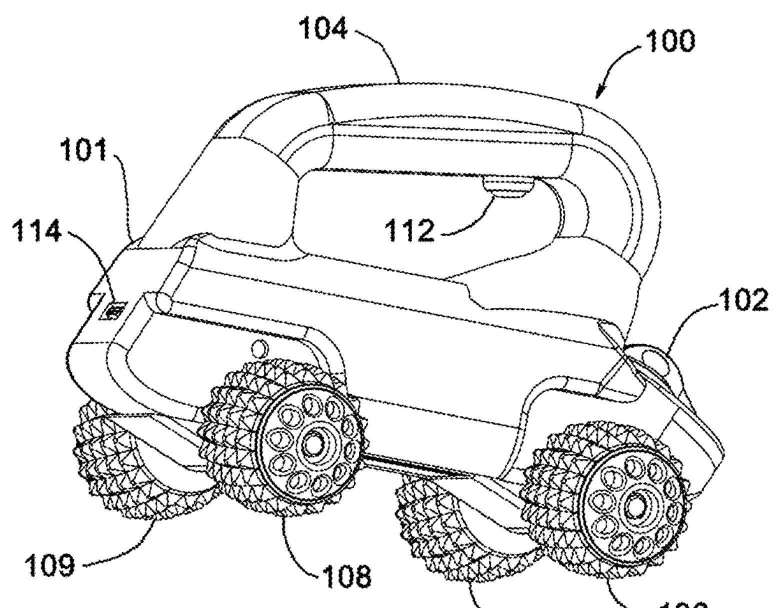

104
100
101
114
112
102
109
108
107
106

FIG. 7

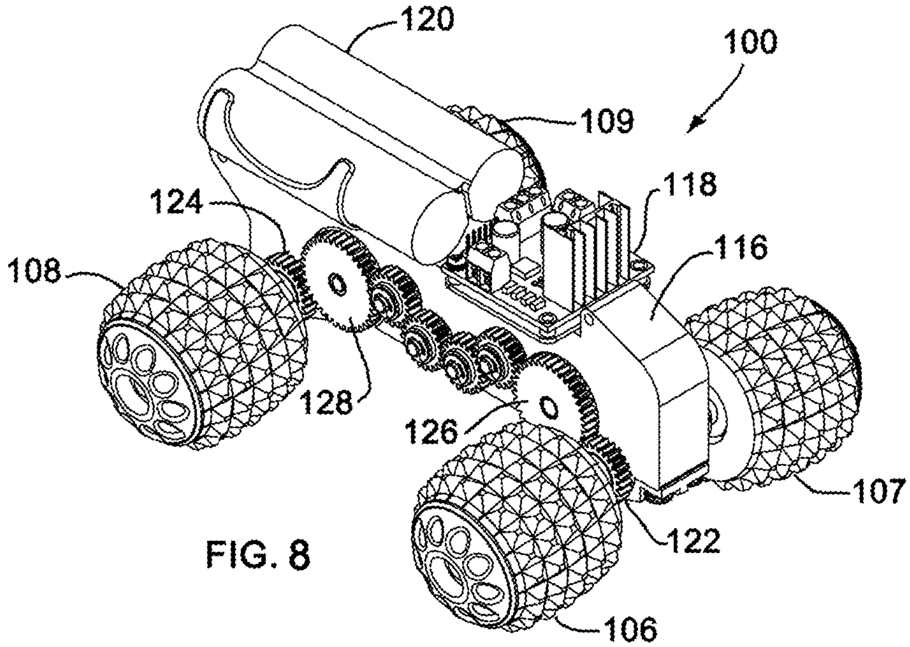

120
100
109
118
124
116
108
128
126
107
122
106

FIG. 8

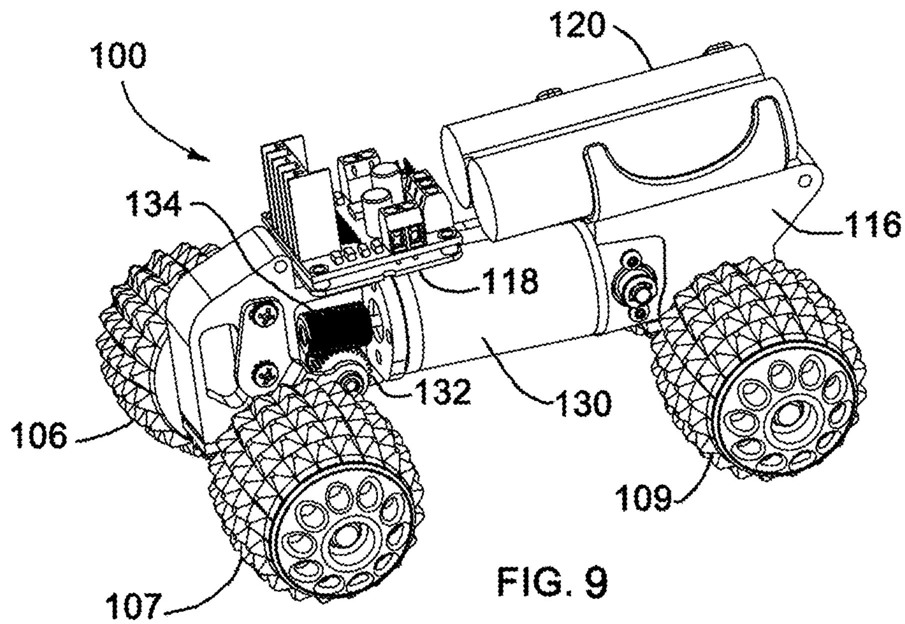

120
100
134
116
118
132
130
106
109
107

FIG. 9

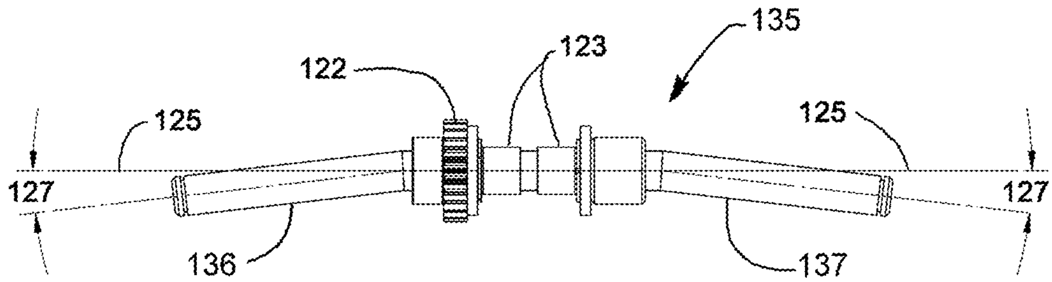


FIG. 10A

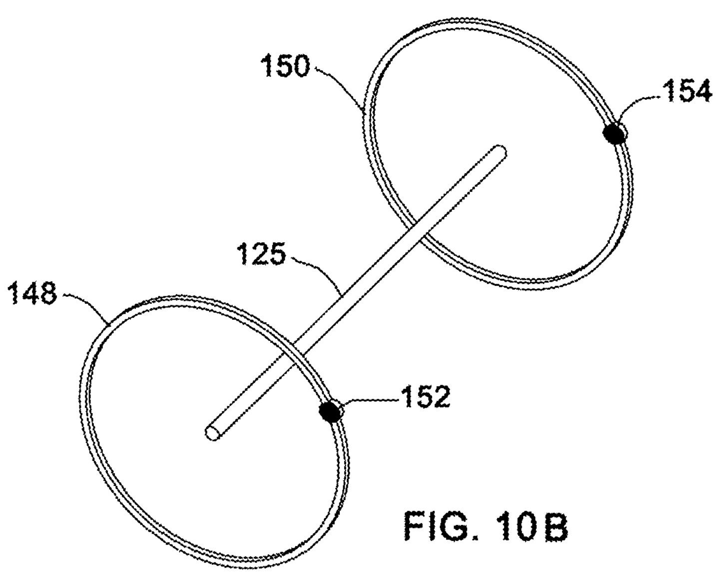


FIG. 10B

FIG. 11

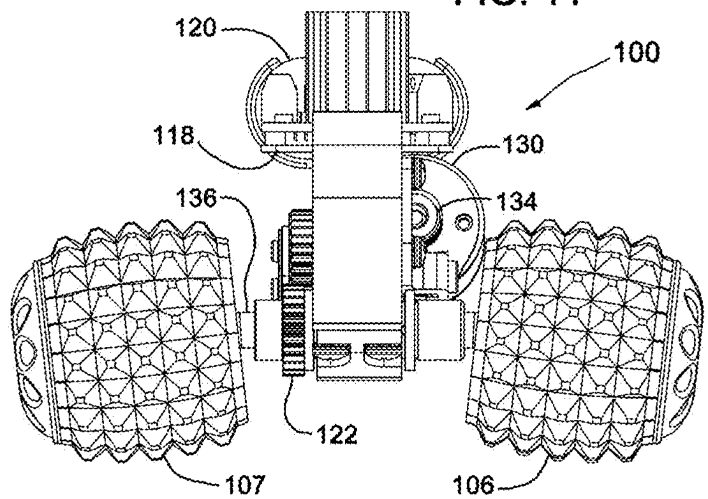
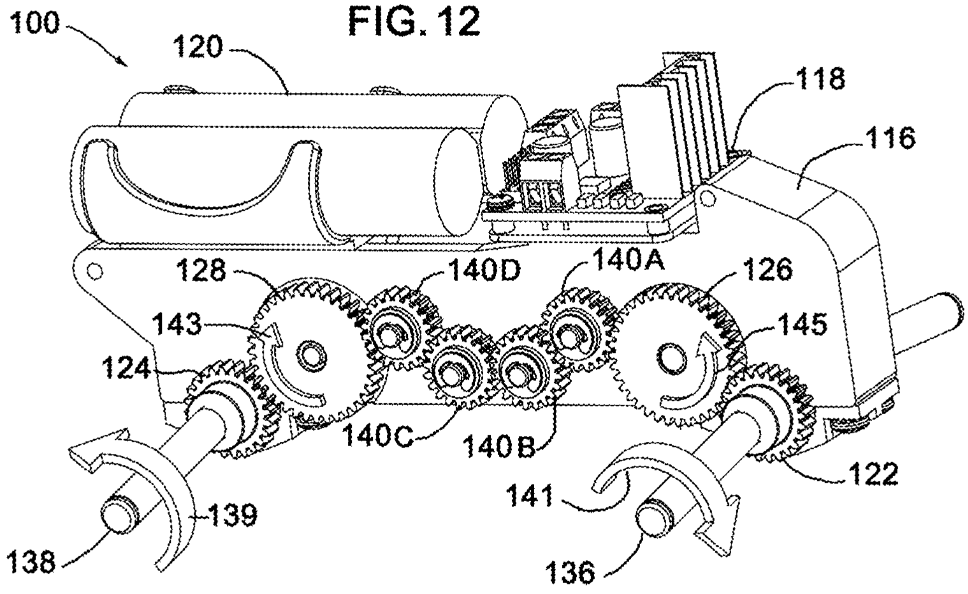

120
100
118
130
136
134
122
107
106

FIG. 12


100
120
118
116
128
140D
140A
126
143
145
124
140C
140B
122
141
139
138
136

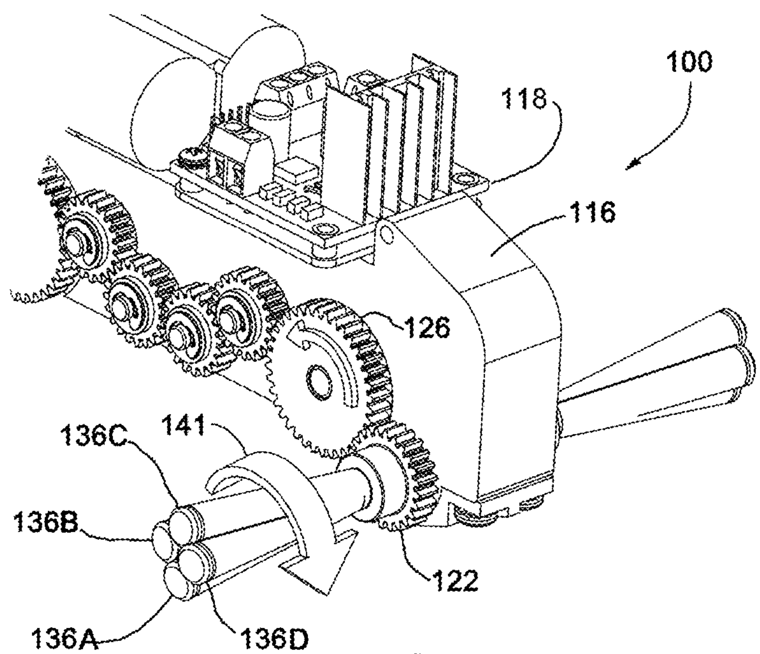

100
118
116
126
141
136C
136B
122
136A
136D

FIG. 13

FIG. 14

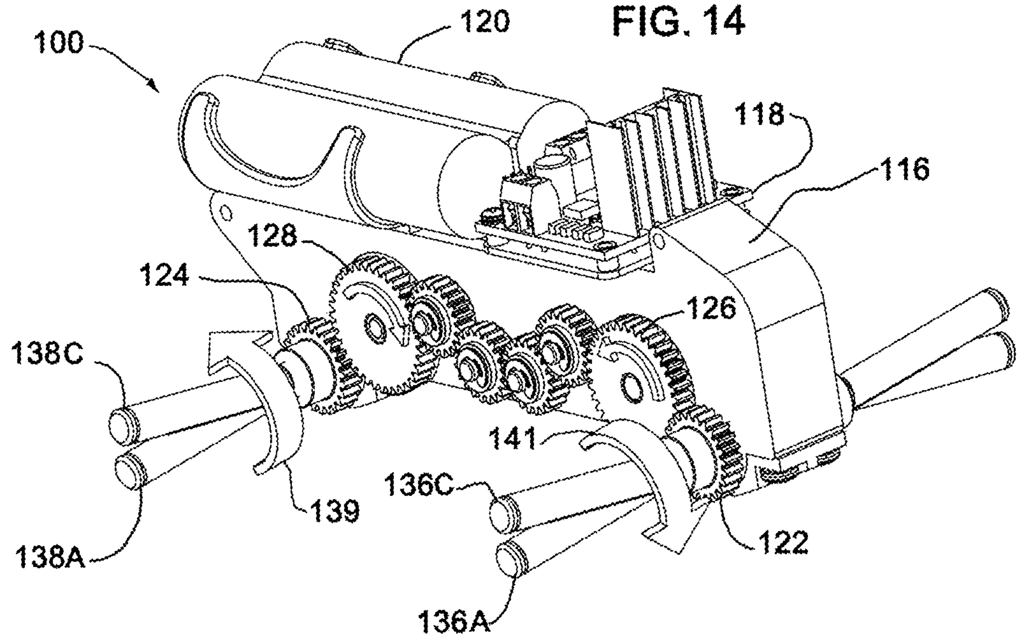

100
120
118
116
128
124
126
138C
141
136C
139
122
138A
136A

FIG. 15

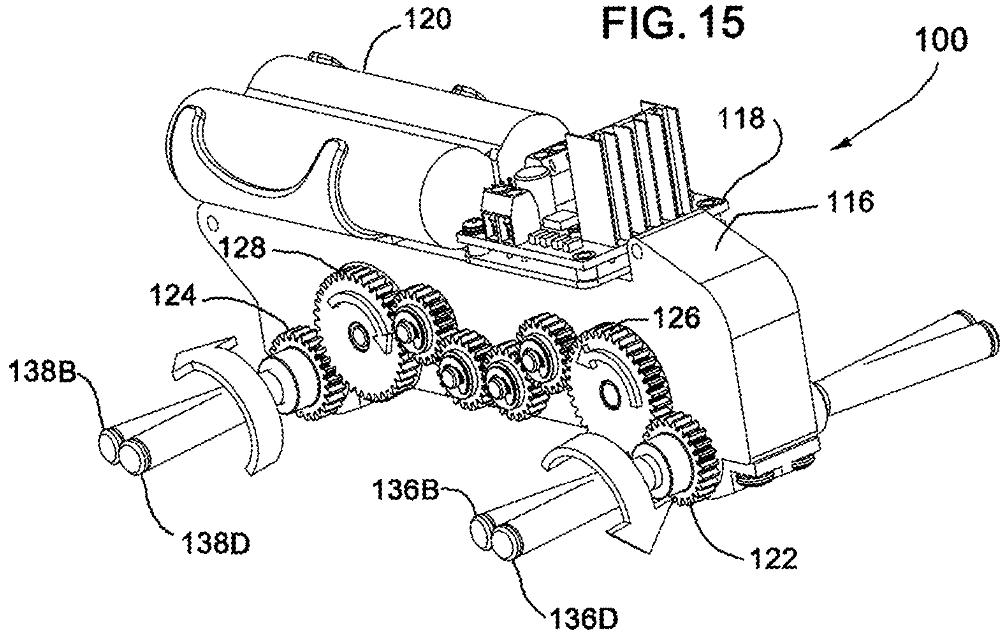


FIG. 16A

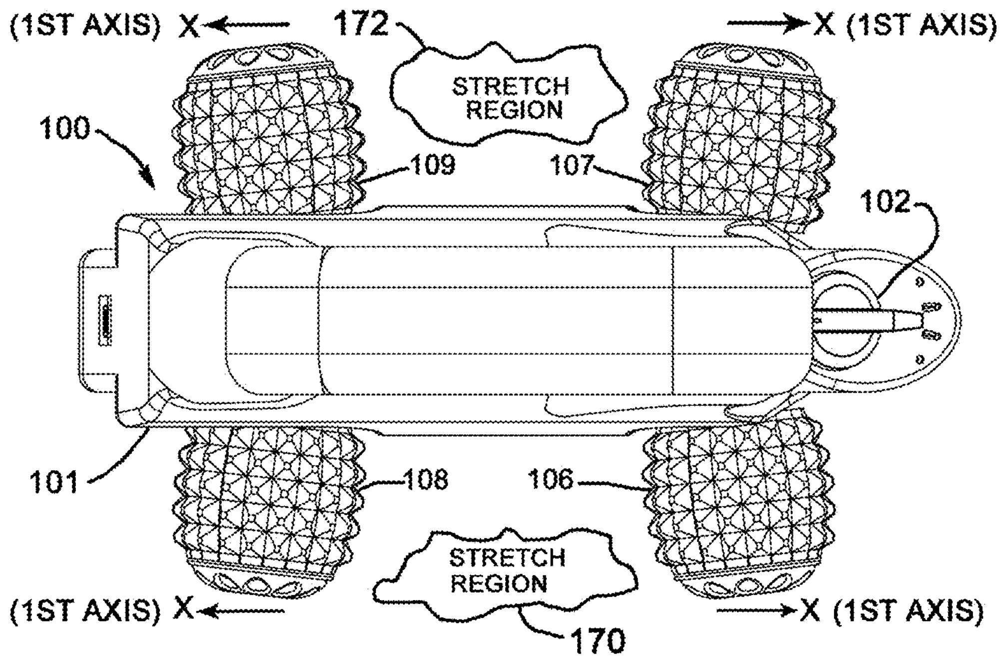
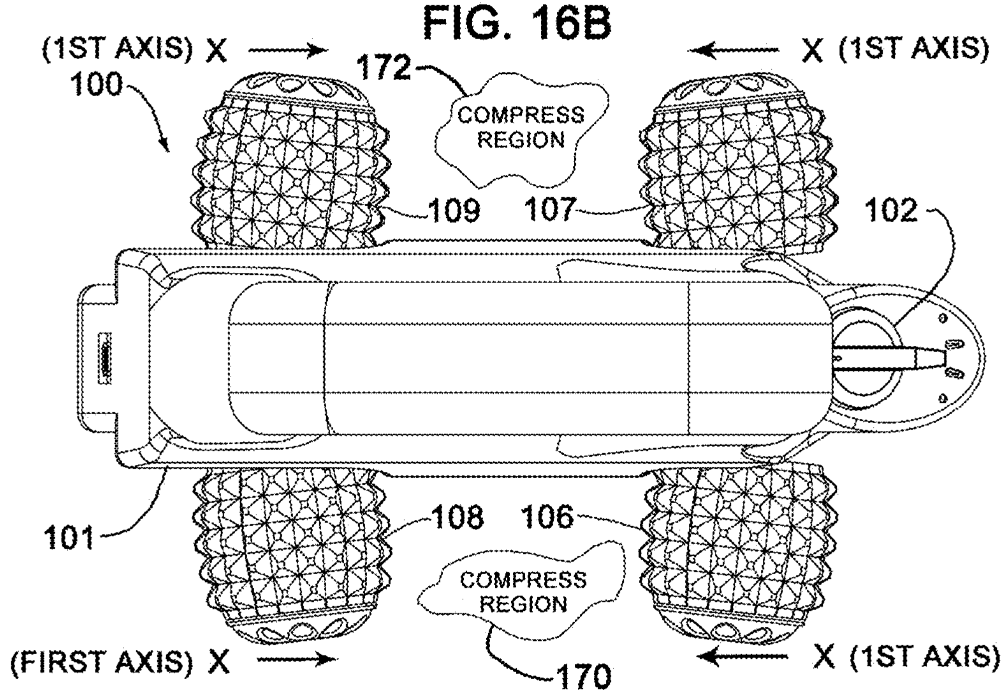


FIG. 16B



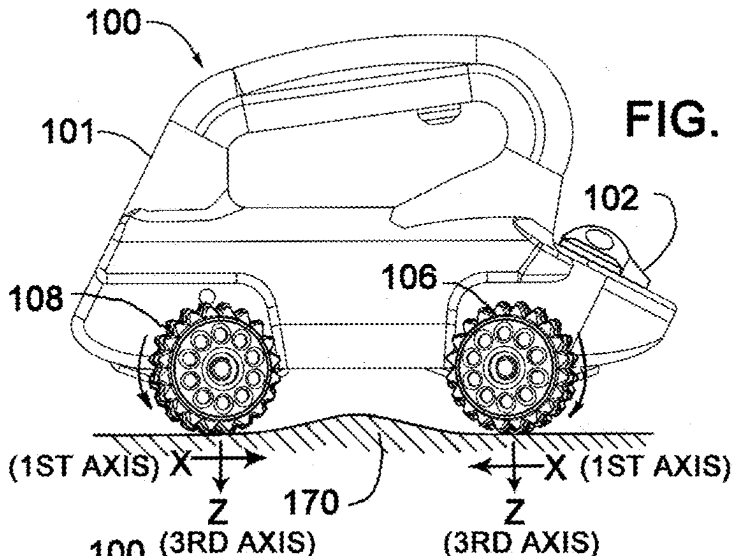


FIG. 17A

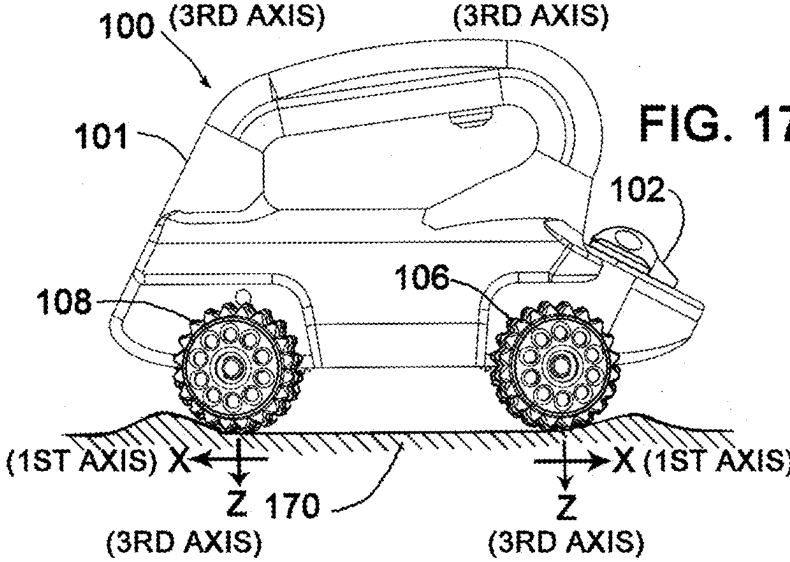


FIG. 17B

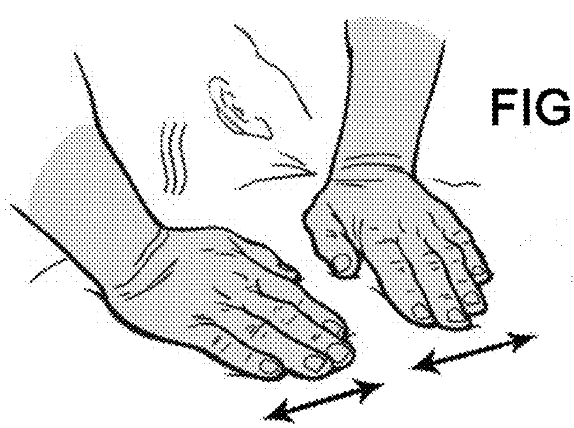


FIG. 17C

FIG. 18

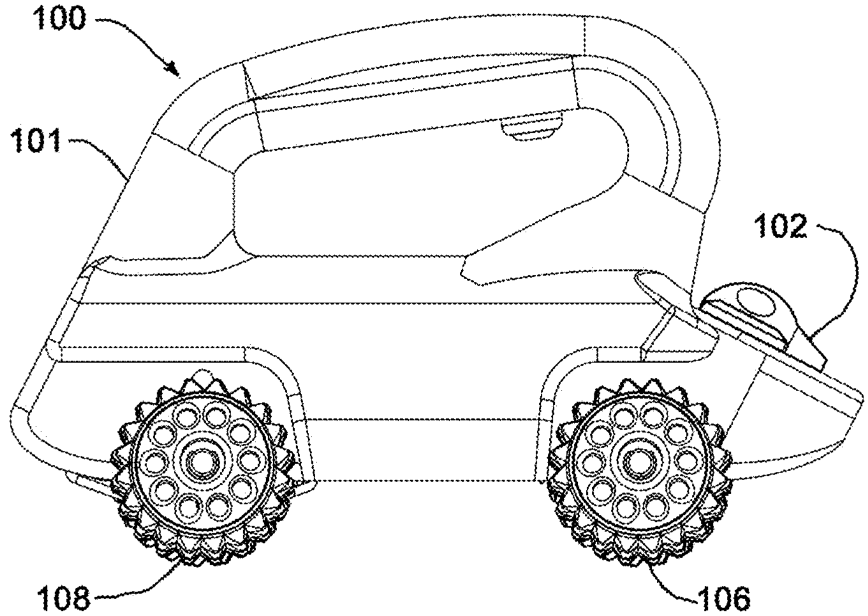

100
101
102
108
106

FIG. 19

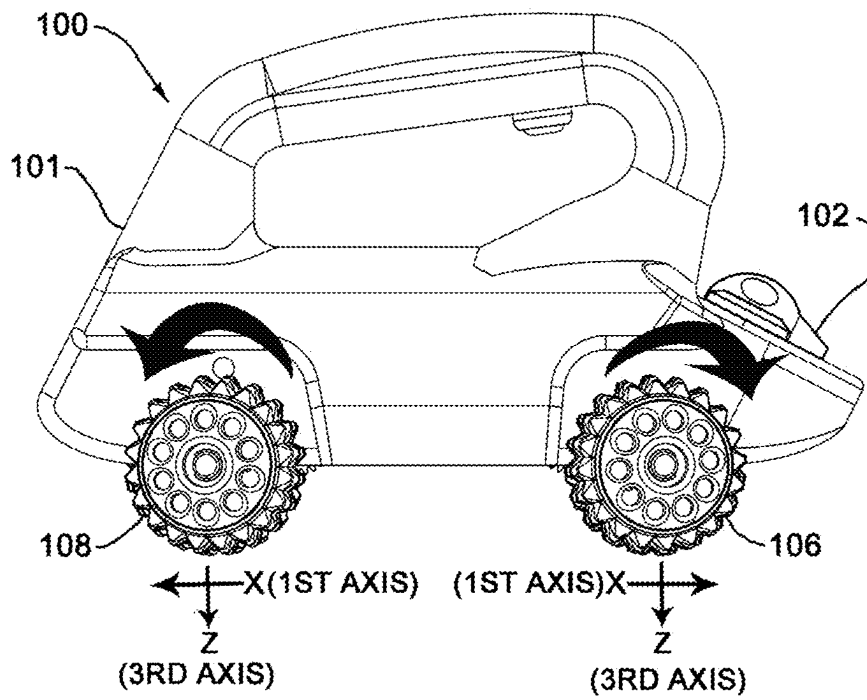
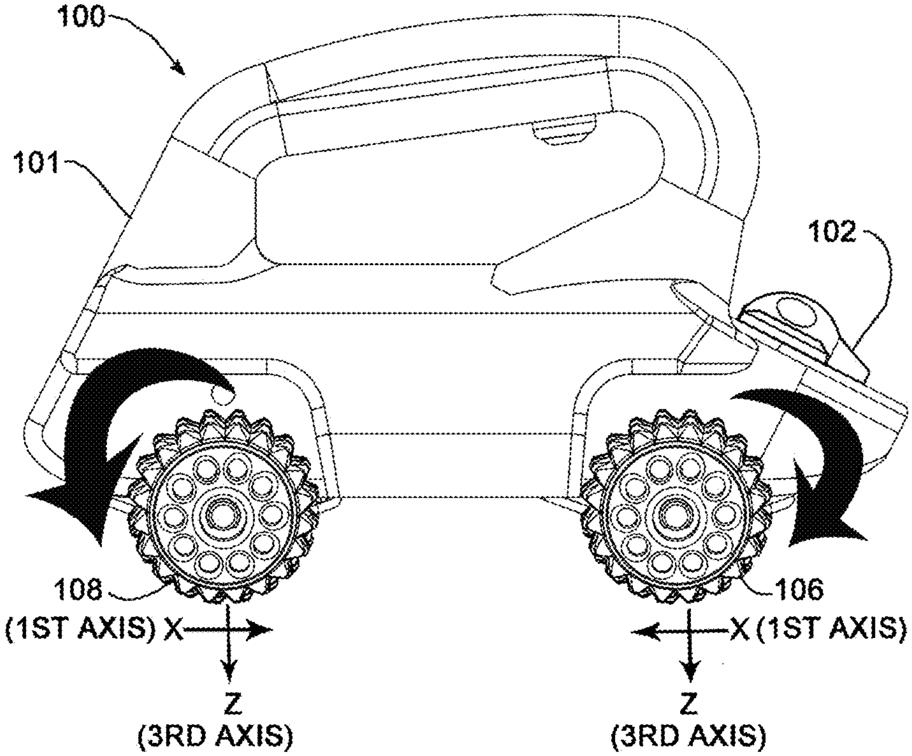

100
101
102
108
106
X(1ST AXIS)
Z
(3RD AXIS)
(1ST AXIS)X
Z
(3RD AXIS)

FIG. 20


100
101
102
108
(1ST AXIS) X
Z
(3RD AXIS)
106
X (1ST AXIS)
Z
(3RD AXIS)

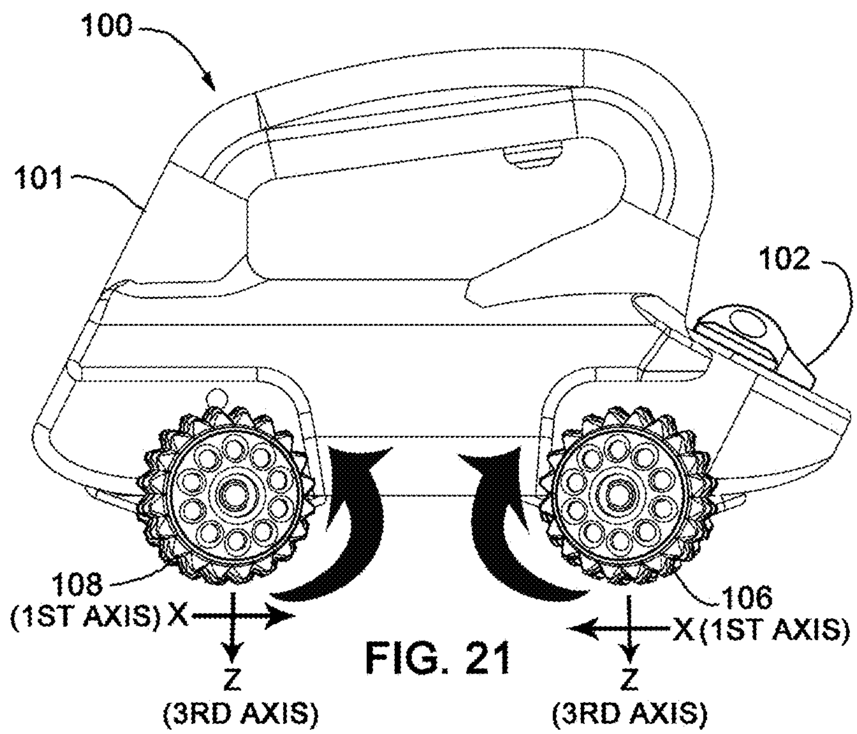

100
101
102
108
(1ST AXIS) X
Z
(3RD AXIS)
106
X (1ST AXIS)
Z
(3RD AXIS)

FIG. 21

FIG. 22

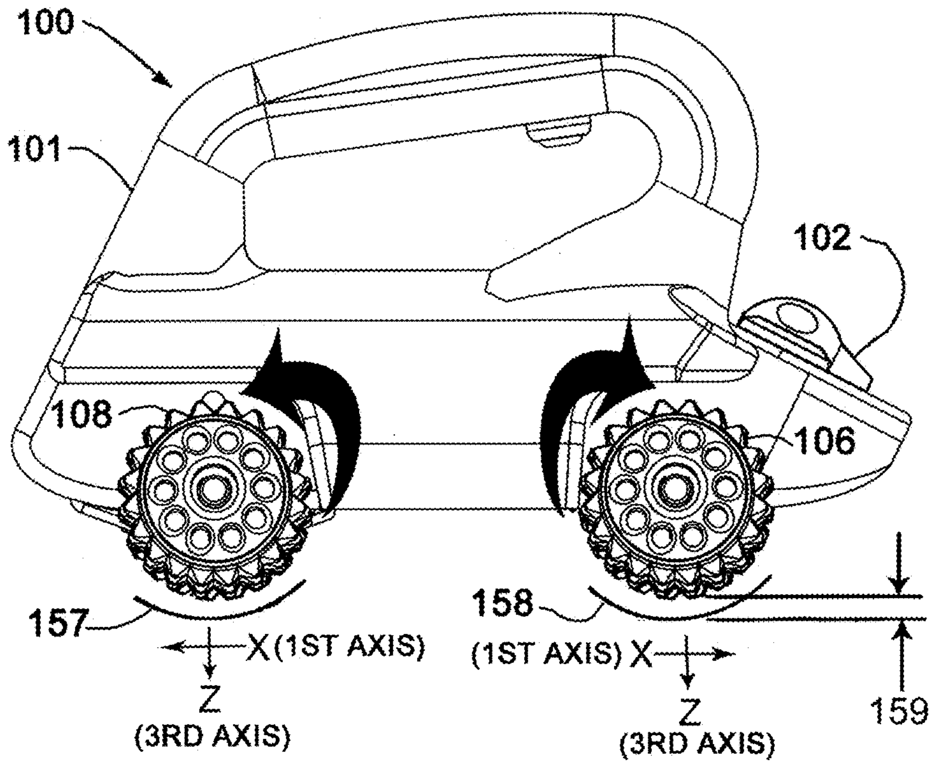

100
101
102
108
106
157
158
159
X (1ST AXIS)
(1ST AXIS) X
Z
(3RD AXIS)
Z
(3RD AXIS)

FIG. 23

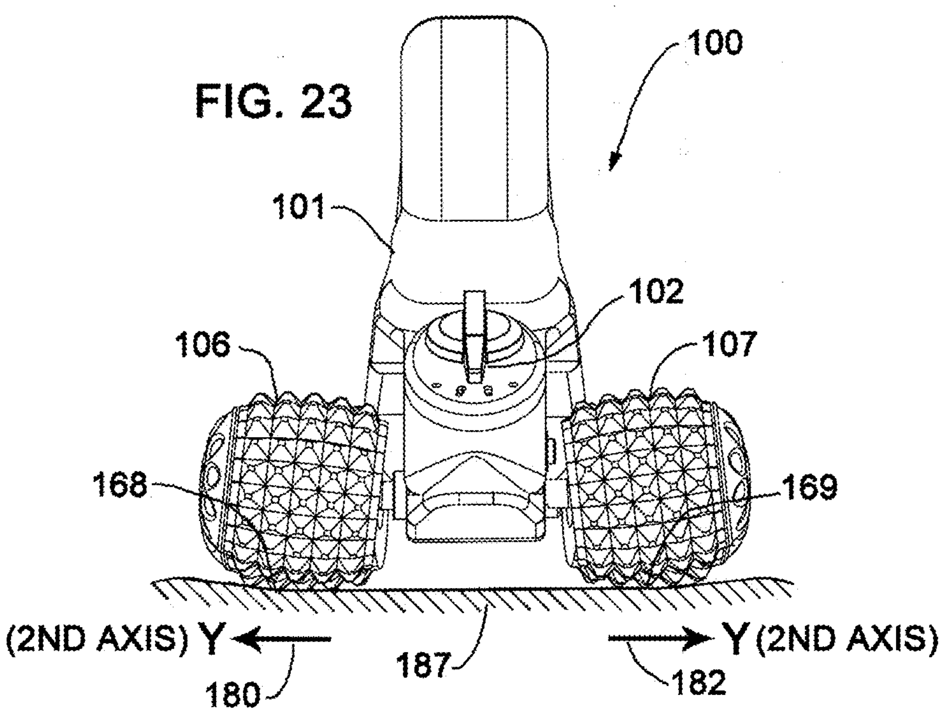
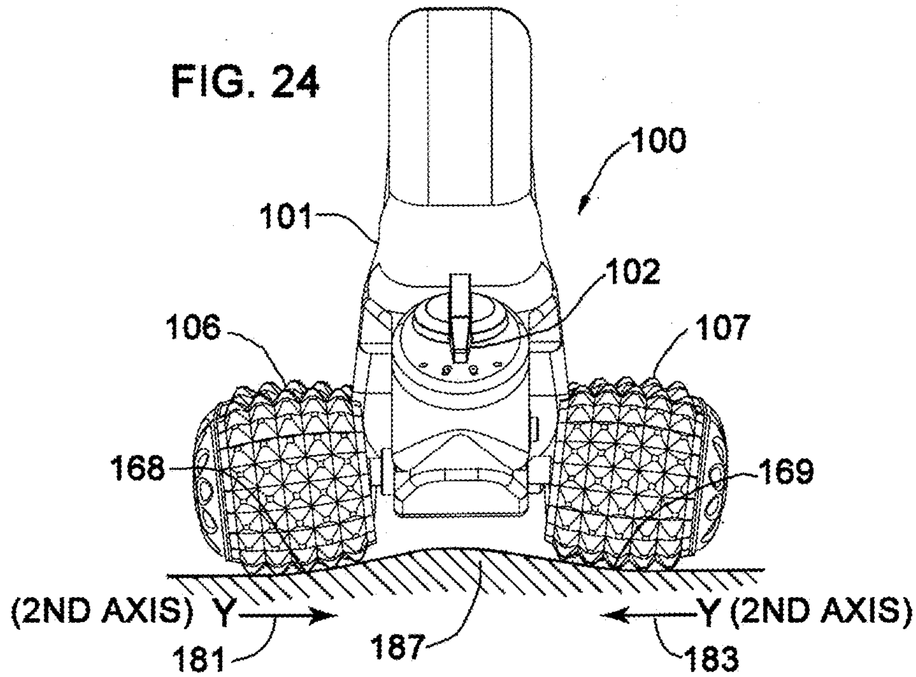

100
101
102
106
107
168
169
(2ND AXIS) Y
Y (2ND AXIS)
180
187
182

FIG. 24


100
101
102
106
107
168
169
(2ND AXIS) Y
Y (2ND AXIS)
181
187
183

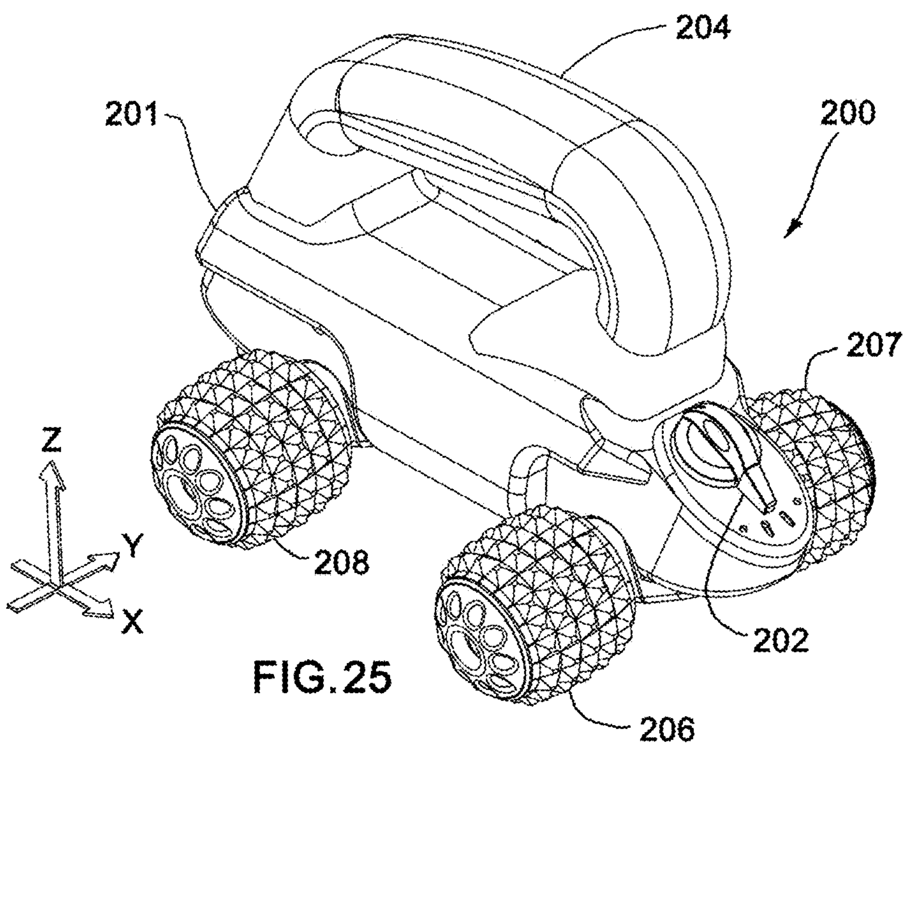

204
201
200
207
Z
Y
X
208
202
206

FIG.25

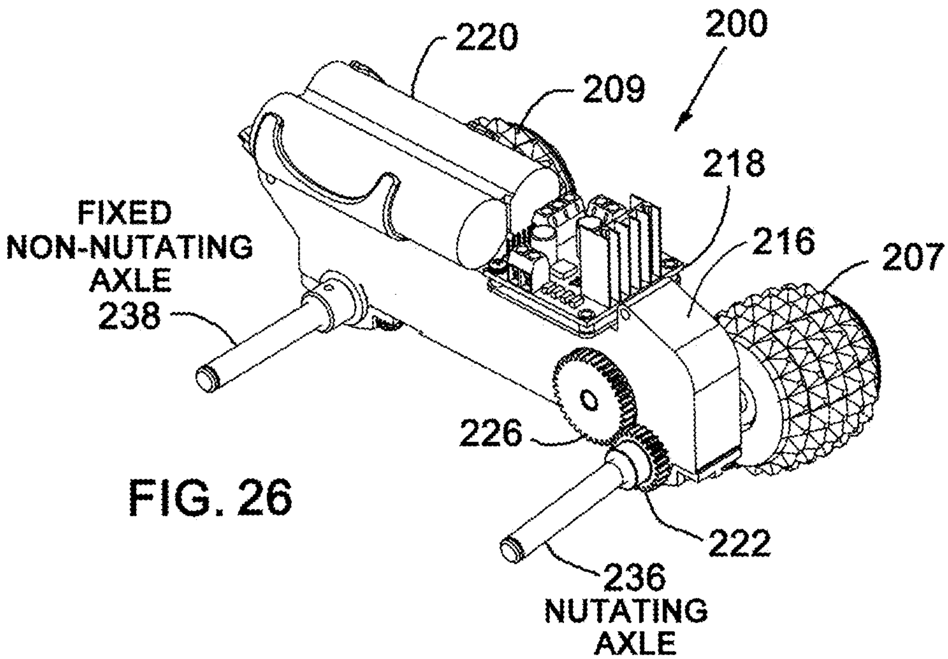

220
209
200
218
216
207
FIXED
NON-NUTATING
AXLE
238
226
222
236
NUTATING
AXLE

FIG. 26

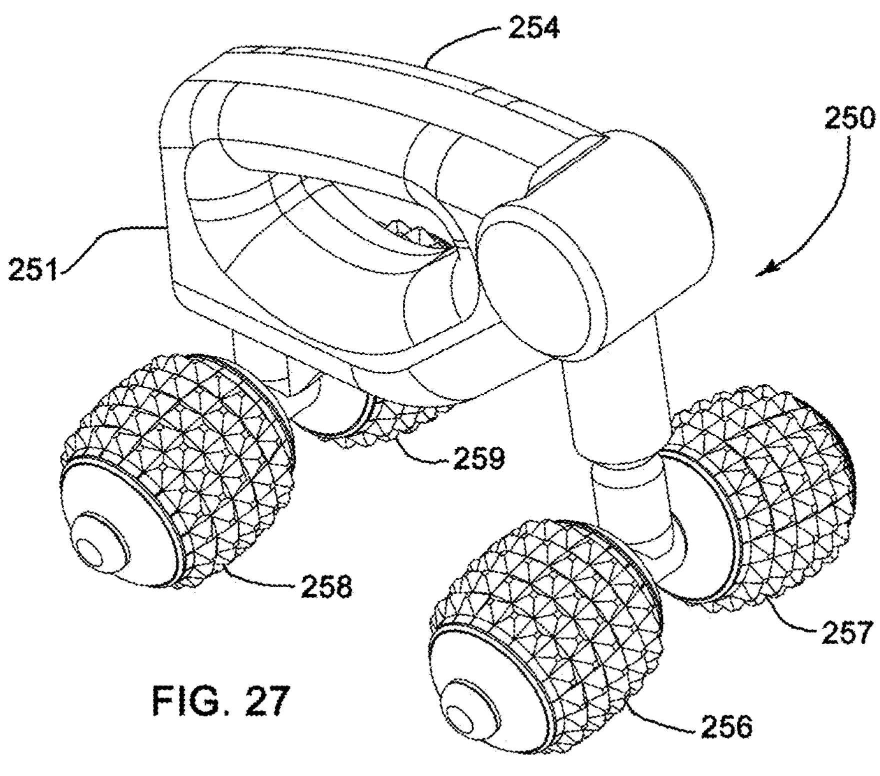

254
250
251
259
258
257
256

FIG. 27

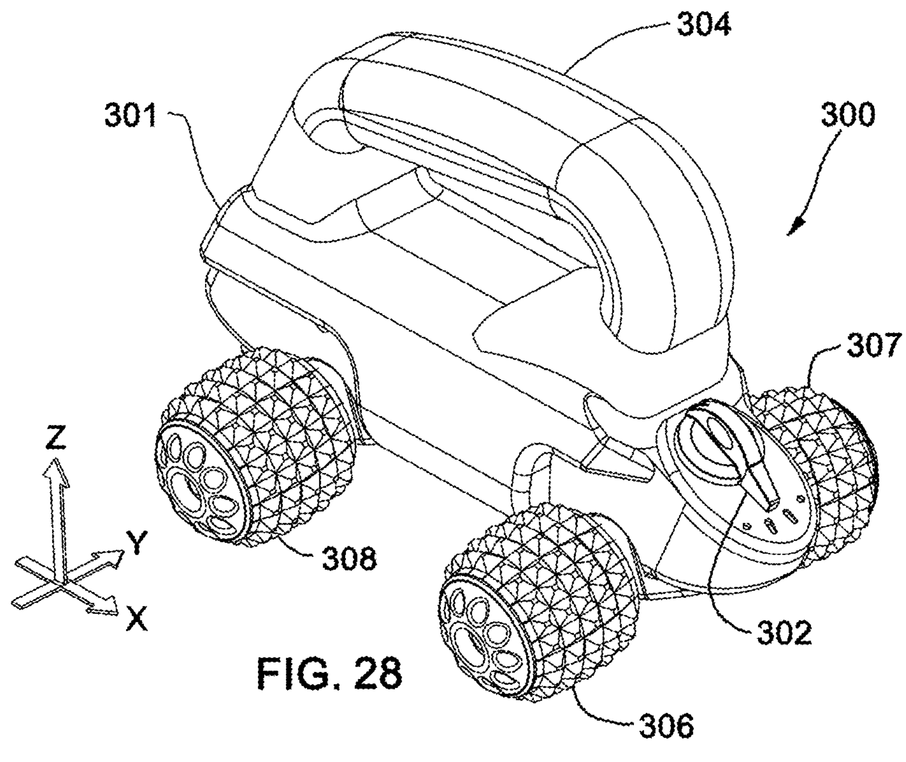


FIG. 28

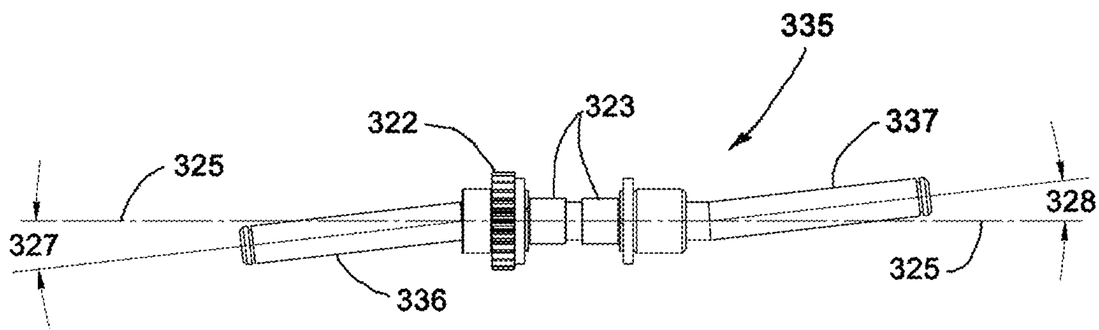


FIG. 29A

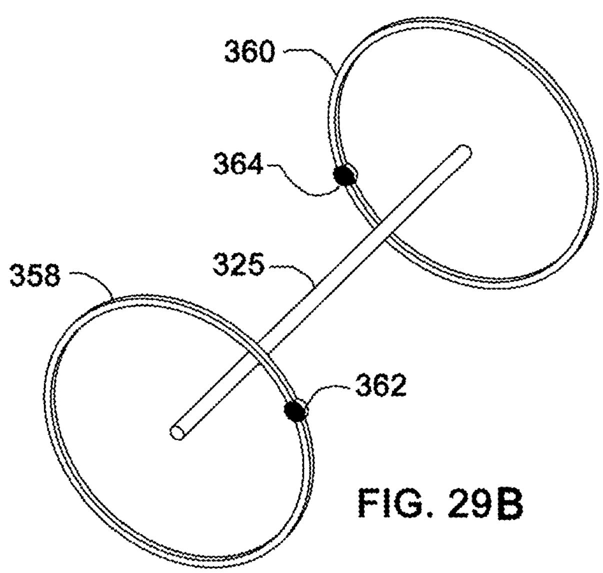


FIG. 29B

FIG. 30

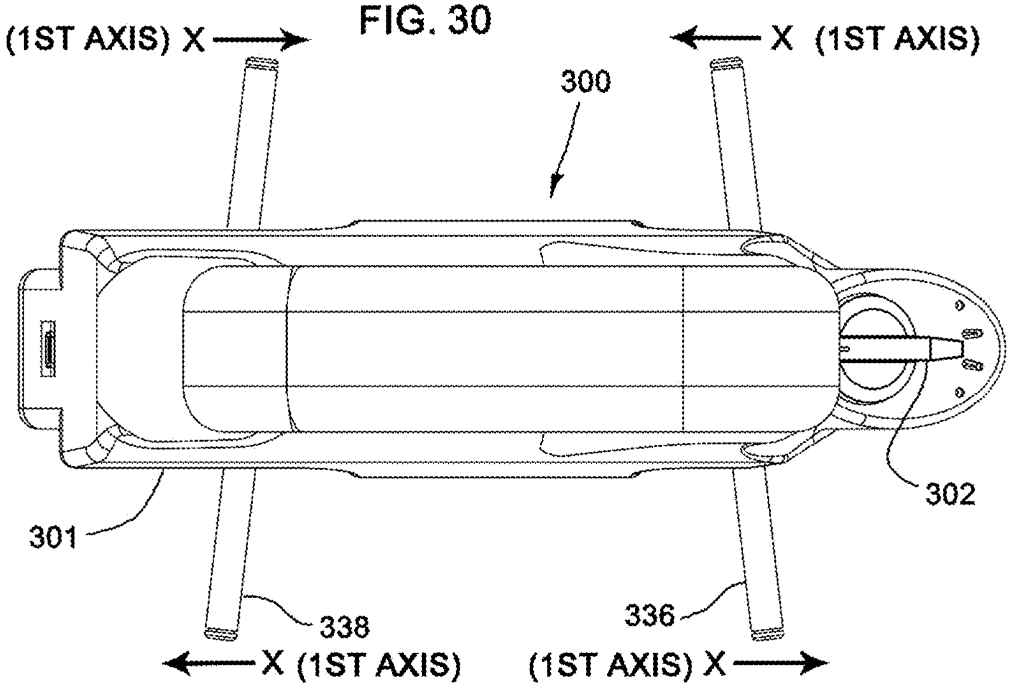

(1ST AXIS) X
X (1ST AXIS)
300
302
301
338
336
X (1ST AXIS)
(1ST AXIS) X

FIG. 31

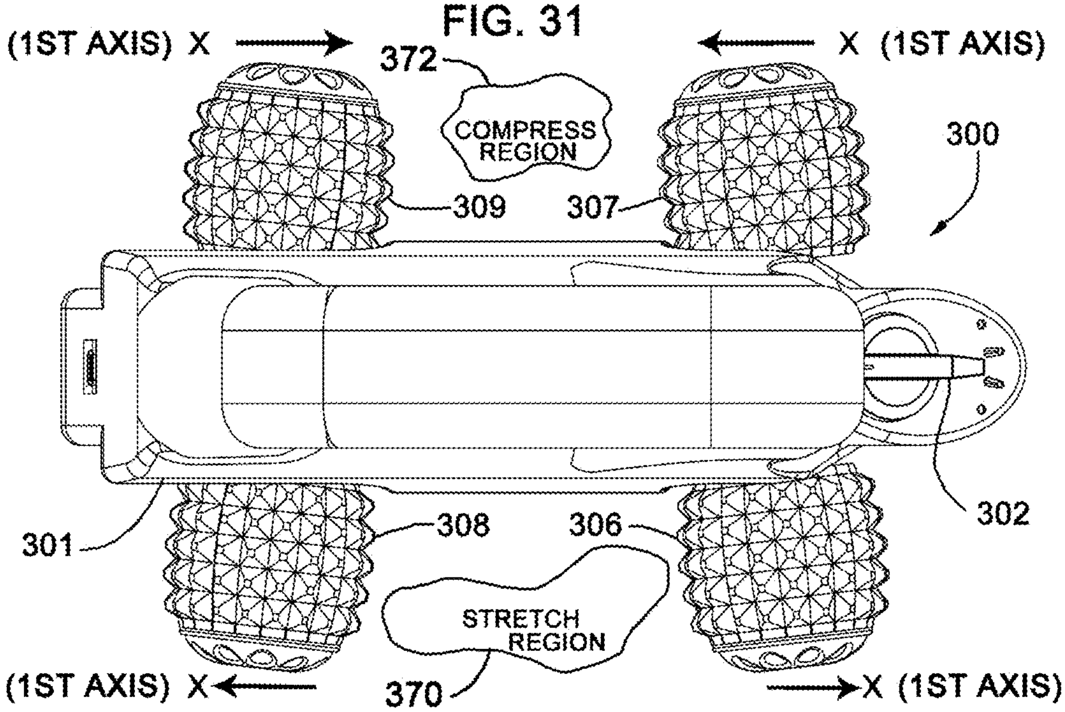
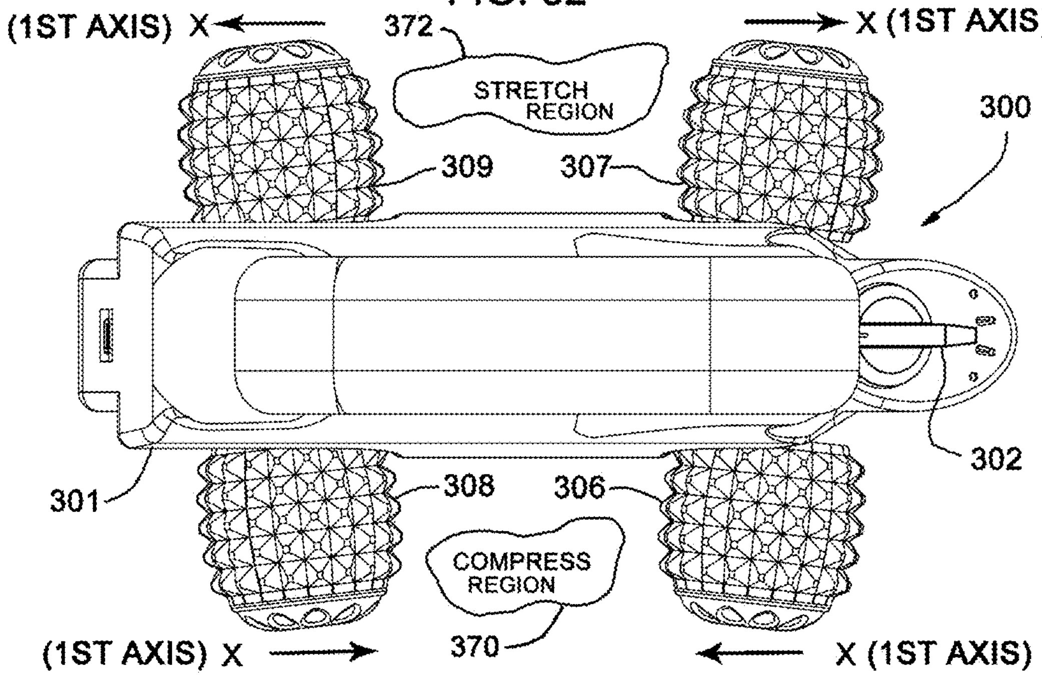

(1ST AXIS) X
X (1ST AXIS)
372
COMPRESS REGION
300
309
307
302
301
308
306
STRETCH REGION
(1ST AXIS) X
370
X (1ST AXIS)

FIG. 32


(1ST AXIS) X
X (1ST AXIS)
372
STRETCH REGION
300
309
307
302
301
308
306
COMPRESS REGION
370
(1ST AXIS) X
X (1ST AXIS)

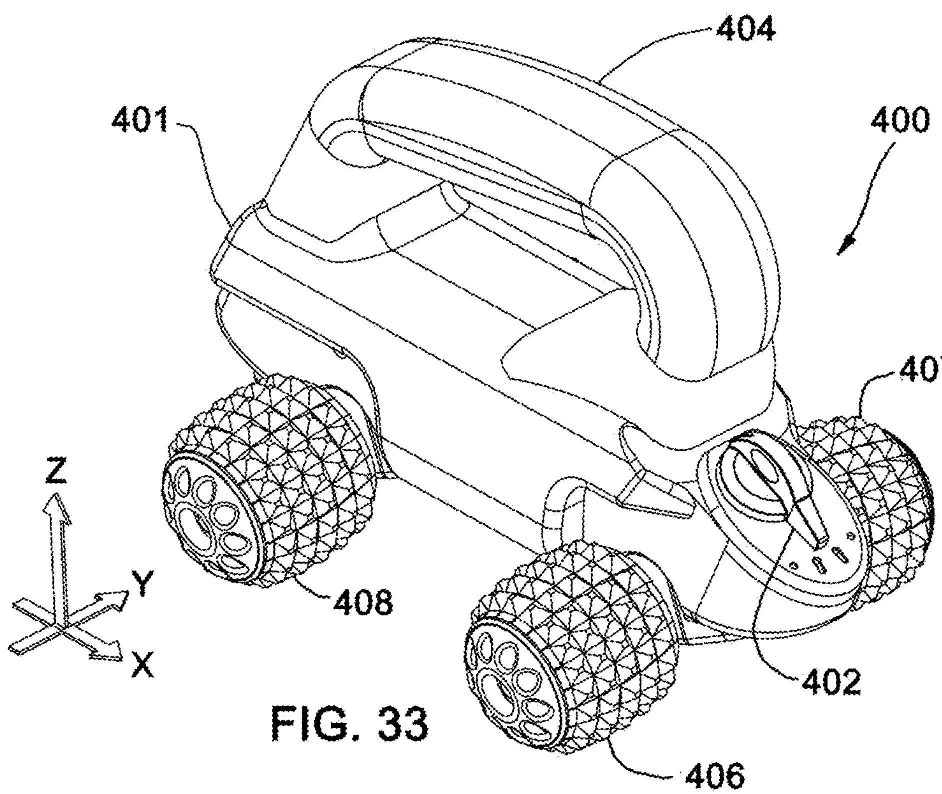

404
401
400
407
Z
Y
X
408
402
406

FIG. 33

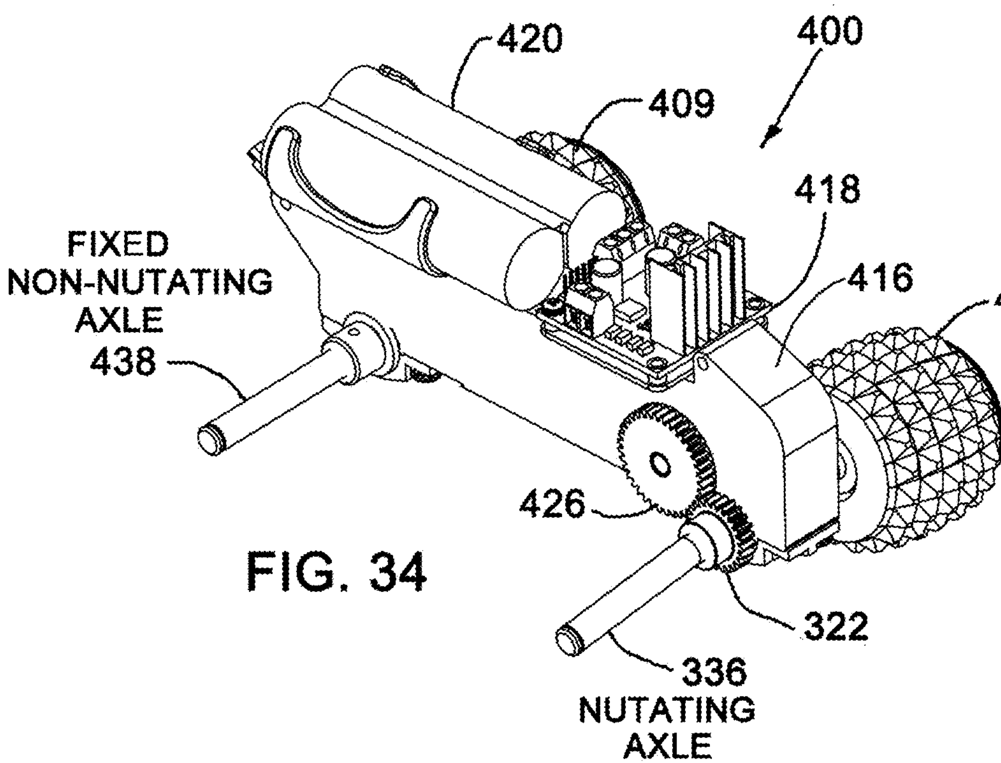

420
400
409
418
FIXED
NON-NUTATING
AXLE
416
407
438
426
322
336
NUTATING
AXLE

FIG. 34

NUTATING MASSAGE DEVICE

BACKGROUND

[0001] The invention herein is in the fields of percussive and rolling massage devices that apply vibratory massage impulses to selected fascia and muscle groups of the human body.

[0002] Percussive massage is the process of using rapid repeated impulses of short duration to specific muscle groups of the human body. While originally performed with the human hands of massage therapists, tools called "massage guns" have more recently become available to perform this type of massage therapy. Massage guns are handheld electromechanical devices which provide repeating mechanical impulses to an impulse head that is pressed against specific areas of the human body. An example is shown in FIG. **1** (Prior Art). While the user holds the impulse head against an area of the body, the motorized device causes the head to rapidly oscillate along axis **904** with various forces and frequencies which are adjustable by the user. The contact surfaces of massage gun heads are shaped like spheres, cups and forks, which are usually provided as exchangeable attachments that snap into the vibrating end of the massage gun. Many massage gun patents have been granted which differ by the structure of the mechanism which produces the reciprocating plunger motion.

[0003] The outer layers of the human anatomy consist of superficial fascia (just below the skin) and deep fascia, which surrounds muscles. Massage guns are said to treat muscles and the deep fascia that surrounds those muscles. They are said to treat sore muscles after exercise, to increase blood circulation, to relieve muscle stiffness, to increase range of joint movement and to reduce inflammatory muscle reaction.

[0004] Rolling massage devices are said to treat the superficial fascia layers by stimulating blood flow and breaking down fat cells. Deep massage using rolling massage devices has been proven in clinical trials to be an effective treatment for cellulite, and variations of these devices are marketed as "Anti-Cellulite Massagers". Some of these devices possess controls which allow the user to adjust the frequency of the vibratory impulses. An example of a typical battery powered massage gun configuration is shown in FIG. **1** (Prior Art). Many other similar configurations are on the market whereupon the device is grasped in the fashion of holding a pistol.

[0005] Specifically, FIG. **1** shows a common configuration of a prior art percussive massage gun **900**. A percussive massage head **905** with a spherical shape is mounted on the end of a piston **906** that reciprocates in the direction of the axis of the arrow **904** within the housing **902** to create a reciprocating plunging movement of the head **905**. The main housing **901** has a cylindrical extension **903** which houses a battery-driven motor. The cylindrical battery assembly **918** has the dual functions of housing the battery and also acting as the handle for the massage gun **900**. The user grips the cylindrical extension **918** in a way similar to grasping a pistol, and then presses the massage head **905** against the target muscle or tissue of the human body. The vibration is initiated by engaging an "ON" switch. This type of massage device produces only up and down reciprocating motion of the massage head **905**. Additionally, the person holding these devices experiences a "reactionary bounce" which causes difficulty in holding the device steady over a chosen muscle target.

[0006] The effectiveness of the massage gun depends upon the user's ability to hold the gun steady while applying pressure to the target muscle location. The vibratory action of the reciprocating head causes an equal and opposite reaction at the user's hand, which makes it difficult to hold the gun focused at the target location, especially at low oscillation speeds. The reaction on the user also causes fatigue when attempting to focus the gun in a specific location for a sustained period of time.

[0007] Other types of massage devices utilize rollers that allow the massage device to traverse along the massage-receiving surfaces. These devices are also said to treat sore muscles after exercise, to increase blood circulation, to relieve muscle stiffness, to increase range of joint movement and to reduce inflammatory muscle reaction. These devices tend to longitudinally stretch muscles and/or the superficial fascia, and are additionally said to be effective in treating cellulite.

[0008] FIG. **2** (Prior Art) shows an example of a prior art handheld roller massage device. The projections **804** on this device are said to induce blood microcirculation as the user traverses the device along the massage-receiving surface. This device additionally provides heat to the roller's stimulating projections. This type of device is said to be of the "passive type" because the massage force may only be induced in response to the user's applied motion. The roller is capable of producing a single downward massage force vector as induced by the user's pressure upon the handle **810**.

[0009] Another passive roller massage device is taught by U.S. Pat. No. 10,143,617B2 (2018) as summarized in FIG. 3 (Prior Art). This disclosure teaches the use of multiple rollers mounted on a semi-flexible axle. Each roller **721** is capable of producing a single massage force vector as induced directly by the user's pressure upon the handles **737** and **738**. The user's pressure results in a vectored massage force as indicated by arrow **716** as the user moves the frame **701** laterally along the direction indicated by arrow **712**. The massage rollers of this device roll freely as shown by arrow **732**, but are incapable of providing percussive massage forces.

[0010] U.S. Pat. No. 10,004,658 B2 (2018) describes a passive massage device that is said to treat cellulite, of which an aspect is shown in FIG. 4 (Prior Art). The prior art device **1600** utilizes two freely rotating rollers **1601** and **1602** that are elastically attached to the base within the interior portion of a cup-like housing **1600**. A user drags the rim of the housing along the surface of the massage-receiving surface in the direction shown by arrow **1690** as a cosmetic fluid is dispensed to lubricate the fascia surface. The interior massage rollers **1601** and **1602** are thus induced to rotate about axis **1611** and **1612** by the user's motion. Each roller "comprises a plurality of polygonal discs with rounded angles, juxtaposed according to the axis of rotation". Further, the "notched shape of the rollers, combined with their secant axes of rotation makes it possible to obtain, during the displacement of the device applied to the skin, a kneading effect." Each roller of this device is limited to providing a constant massage vector force in only one direction in response to the pressure provided by the elastic arm suspension. That massage force is orthogonal to the massage receiving surface. A deficiency of this invention resides in the fact that a lubricant is required to facilitate comfort when dragging the rim of the device along the massage-receiving fascia surface.

[0011] The device shown in FIG. **5** (Prior Art) combines the benefits of rolling massage with the benefits of percussive massage. Specifically, US patent application 2022/016 0578 teaches an active massage device with rollers that may be traversed along the massage-receiving surface in the direction shown by arrow **1244**. The device possesses two stabilizing rollers **1220** and **1230** which freely rotate upon axle **1211**. A third roller **1224** is mounted on a motor-driven piston that pulsates bidirectionally with an up and down reciprocating motion along a single vector indicated by arrow **1248**. The roller **1224** also rotates freely upon axle **1240** as the user traverses the assembly **1200** along the massage-receiving surface. The axles **1240** and **1211** are fixed to the device in a direction that is orthogonal to the direction **1244**. The stabilizing rollers act to relieve the "reactionary bounce" problem encountered by the user in holding a conventional massage gun steady. However, none of the rollers **1220**, **1230**, or **1224** produce 3-dimensional massage contact forces upon the massage-receiving fascia. Furthermore, none of the rollers induce opposing forces in a direction parallel to the massage-receiving surface to stretch the fascia.

SUMMARY OF THE INVENTION

[0012] A preferred embodiment is shown in FIG. **6** which illustrates a handheld, motorized massage device that utilizes four massage rollers with stimulating projections that are each mounted on nutating axles. The device combines the advantages of percussive massage and the advantages of rolling massage while providing unique 3-dimesnional massage force vectors at each roller. Each of the four nutating rollers produces unique massage force vectors bidirectionally along three orthogonal axes against the massage-receiving fascia region beneath that roller. Additionally, the front and rear nutating axles are synchronized to produce opposing rotational motion which acts to stretch and compress the regions along the planar surface of the massage-receiving fascia between the front and rear massage rollers. This reciprocating stretching action, combined with a percussive massage action, simulates the actions of massage therapists which are said to be effective in treating cellulite and repairing muscle damage.

[0013] Alternate embodiments are explained whereupon the nutation angle of each peripheral end of the nutating axles are diametrically opposed in order to produce a different type of 3-dimesnional massage vector. In one alternate embodiment, the stretching motion along the fascia surface is synchronously alternated between the right and left nutating roller pairs.

[0014] In some embodiments, the motion of the front and rear rollers are synchronized mechanically, such as by gears or timing belts. In other embodiments, the two nutating axles are driven by independent motors which are electronically synchronized.

[0015] Additional embodiments describe variants where only two of the four rollers nutate while the remaining two rollers act as stabilizers. In all embodiments, the user may hold the device stationary upon a target fascia region, or alternatively, traverse the device with reciprocating motion along the massage-receiving surface.

[0016] This disclosure frequently uses the words "nutating", "nutation", and "nutate" which may be perhaps obscure. The act of nutating refers to rocking, swaying or wobbling motion of a feature or features as they rotate about a common axis.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] FIG. **1** (Prior Art) shows a common configuration of a prior art percussive massage gun.

[0018] FIG. **2** (Prior Art) shows an example of a prior art handheld roller massage device.

[0019] FIG. **3** (Prior Art) shows an example of a prior art multi-roller handheld massage device.

[0020] FIG. **4** (Prior Art) shows an example of a prior art multi-roller passive massage device.

[0021] FIG. **5** (Prior Art) shows an example of a prior art hybrid massage device that combines the benefit of percussive massage with the stability advantage of rolling massage devices.

[0022] FIG. **6** is an isometric view of a first embodiment of a nutating massage device.

[0023] FIG. **7** is an alternate isometric view of the first embodiment shown in FIG. **6**.

[0024] FIG. **8** is an isometric view of the nutating massage device of the first embodiment with the outer casing removed.

[0025] FIG. **9** is an alternate isometric view of the nutating massage device of the first embodiment with the outer casing removed.

[0026] FIG. **10**A is a frontal view of one nutating axle of the first embodiment showing the nutation angles on the right and left peripheral ends of the axle.

[0027] FIG. **10**B is diagram explaining the phase relationship between the right and left nutating axle tips according to the axle configuration of FIG. **10**A.

[0028] FIG. **11** is a frontal view of the nutating massage device of the first embodiment with the outer casing removed.

[0029] FIG. **12** is a right side isometric view of the nutating massage device of the first embodiment with the massage rollers removed and without the outer casing.

[0030] FIG. **13** is an isometric view of the front nutating axle of the first embodiment showing the tip of the axle superimposed into four rotational positions.

[0031] FIG. **14** is an isometric view of the front nutating axle and rear nutating axle of the first embodiment showing the tips of the axles superimposed in two rotational positions designated as 6 o'clock and 12 o'clock.

[0032] FIG. **15** is an isometric view of the front nutating axle and rear nutating axle of the first embodiment showing the tips of the axles superimposed in two rotational positions designated as 3 o'clock and 9 o'clock.

[0033] FIG. **16**A is a top view of the massage device of the first embodiment showing the front rollers having moved apart from the rear rollers along the X-axis.

[0034] FIG. **16**B is a top view of the massage device of the first embodiment showing the front rollers and rear rollers having moved closer to each other along the X-axis.

[0035] FIG. **17**A is a side elevational view of the massage device showing the compressed fascia region between the rollers.

[0036] FIG. **17**B is a side elevational view of the massage device showing the stretched fascia region between the rollers.

[0037] FIG. **17**C is an illustration of the hands of a massage therapist using a myofascial massage technique.

[0038] FIG. **18** is a right side view of the massage device of the first embodiment showing the right front roller and right rear roller located at the 12 o'clock position.

[0039] FIG. **19** is a right side view of the massage device of the first embodiment showing the right front roller having moved to the 3 o'clock positions and right rear roller having moved to the 9 o'clock position.

[0040] FIG. **20** is a right side view of the massage device of the first embodiment showing the right front roller having moved to the 6 o'clock positions and right rear roller having moved to the 6 o'clock position.

[0041] FIG. **21** is a right side view of the massage device of the first embodiment showing the right front roller having moved to the 9 o'clock positions and right rear roller having moved to the 3 o'clock position.

[0042] FIG. **22** is a right side view of the massage device of the first embodiment showing the right front roller having moved to the 12 o'clock position and right rear roller having moved to the 12 o'clock position.

[0043] FIG. **23** is a frontal view of the massage device of the first embodiment showing the contact regions of the left front roller and the right front roller having moved apart along the Y-axis.

[0044] FIG. **24** is a frontal view of the massage device of the first embodiment showing the contact regions of the left front roller and the right front roller having moved towards each other along the Y-axis.

[0045] FIG. **25** is an isometric view of a second embodiment of the nutating massage device.

[0046] FIG. **26** is an isometric view of a second embodiment of the nutating massage device with the outer casing removed and the right rollers removed to expose the axles.

[0047] FIG. **27** is an isometric view of a third embodiment of the nutating massage device with a simplified outer casing.

[0048] FIG. **28** is an isometric view of a fourth embodiment of the nutating massage device.

[0049] FIG. **29**A is a view of one nutating axle of the fourth embodiment showing the opposing nutation angles on the right and left peripheral ends of the axle.

[0050] FIG. **29**B is diagram explaining the phase relationship between the right and left nutating axle tips according to the axle configuration of FIG. **29**A.

[0051] FIG. **30** is a top view of the fourth embodiment with the massage rollers removed to show the axle tip positions at their synchronized extremes along the X-axis.

[0052] FIG. **31** is the same top view of the fourth embodiment as shown in FIG. **30** with the massage rollers shown at their synchronized extremes along the X-axis.

[0053] FIG. **32** is the same top view of the fourth embodiment as shown in FIG. **31** with the massage rollers shown at the opposite synchronized extremes along the X-axis.

[0054] FIG. **33** is an isometric view of a fifth embodiment of the nutating massage device.

[0055] FIG. **34** is an isometric view of a fifth embodiment of the nutating massage device with the outer casing removed to show the interior drive components.

DETAILED DESCRIPTION

[0056] FIG. **6** illustrates a preferred embodiment of the massage device disclosed herein which includes four massage rollers which are rotatably mounted on two nutating axles which cause the rollers to rotate in a coordinated wobbling fashion. The device **100** consists of a casing body **101** which includes a handle portion **104**. The front rollers **106** and **107** are freely rotatable upon a first nutating axle (the front axle) and the rear rollers **108** and **109** (not shown) are freely rotatable upon second nutating axle, which is designated herein as the rear nutating axle. Each of the two axles are rotationally driven by a battery-powered motor **130**. The speed of the nutating axle motion is controlled by the velocity of the battery-powered drive motor **130** which is mounted internally within the casing **101**. The operator controls the motor speed by setting the position of the speed control knob **102**. The reference axes X, Y, and Z are shown to orient the vectors showing the multiple directions of the massage forces as further explained below.

[0057] In general, the operator grasps the device by the handle portion **104** and exerts pressure along the negative Z axis. The operator may use the device in two different modes. In the first mode, the operator may hold the device stationary over the target region. Alternately, the device may be freely traversed back and forth along the X-axis of the massage receiving regions in the second operational mode. In either mode, bidirectional pulsating forces are induced along three orthogonal directions at the contact region under each massage roller. In addition, stretching and compression of the fascia is induced along the directions of the "stretching axes" herein, including along the X-axis and the Y-axis.

[0058] The second mode is called the "freely traversable" mode. In the context of this disclosure, the term "freely traversable" means that the device can be traversed along the massage-receiving surface while inducing three-dimensional pulsations at each roller contact, and without causing any massage roller to skid or drag along the massage-receiving surface.

[0059] FIG. **7** is a rear lower isometric view of the massage device **100** which shows the front nutating rollers **106** and **107**, in addition to the rear nutating rollers **108** and **109**. A trigger button **112** is shown on the underside of the handle portion **104**. The trigger button **112** is used by the operator to actuate the motor-driven nutating axles, where the term "motor-driven" means that the axles are rotationally powered by the motor. Speed control knob **102** is adjustable by the operator to control the rotational velocity of the nutating axles which induce identical nutation of the rollers mounted thereon. Charging port **114** is used to charge the internal batteries which power the motor.

[0060] FIG. **8** is a front isometric view of the massage device **100** with the outer casing removed in order to show the arrangement of the internal components which are attached to the main frame **116**. This view is looking at the right side of the device **100**. A pair of batteries **120** is shown attached to the frame **116** just rearward of an electronic assembly **118** which possesses the motor control and battery charging circuitry. The batteries could be of the NICAD, lithium ion, sodium ion or other known battery types. The front nutating rollers **106** and **107** are driven by pinion **122** which is driven by gear **126**. Rear nutating rollers **108** and **109** are driven by gear **128** which drives pinion **124**.

[0061] FIG. **9** is a front isometric view of the massage device **100** with the outer casing removed and shows the left side of the device **100**, which is the side opposite of the gear train shown in FIG. **8**. This figure shows the position of the drive motor **130**. A worm pinion **134** is attached to the motor drive shaft and rotates worm gear **132**. The worm gear **132**

is attached to the gear **126** (FIG. **8**) via a cross shaft (not shown), such that the motor **130** drives the gear train shown in FIG. **8** while the trigger button **112** is compressed.

[0062] FIG. **10**A shows a view of the front nutating axle assembly **135**. The axle rotates within bearings **123** about axis **125**, as driven by pinion **122** which is fixedly attached to the axle assembly **135** which possesses two axle extensions **136** and **137**. Both axle extensions **136** and **137** are bent at an angle **127** which is called the mitating angle. The left and right nutating angles **127** are shown to be equal in a preferred embodiment of axle **136**, but the invention may be implemented with unequal nutating angles. The term mutation is derived from the fact that the peripheral extremities (tips) of axle **135** will rotate within two parallel circular orbits as the axle assembly **135** rotates about axis **125**.

[0063] FIG. **10**B is a diagram explaining the phase relationship between the right and left nutating axle tips according to the axle configuration of FIG. **10**A. The wire **125** represents the rotational axis of the axle as shown in in FIG. **10**A, while the circles **148** and **150** represent the circular paths (exaggerated) of the axle tip extremities. Nutation circle **148** represents the loci of the path of the right nutating axle tip orbit, while nutating circle **150** represents the orbital path of the left nutating axle tip. Label **152** indicates the position of the right axle tip along its nutation circle at any given point in time, while **154** represents that of the left axle tip. In the example of FIG. **10**B, the right axle tip **152** is at its 2 o'clock position while the left axle tip **154** is also it its 2 o'clock position. The rotation of the two axle tips is said to be "in phase" because they both reside at identical angular orientations along their nutation circles at any given instant in time.

[0064] A rear nutating axle assembly **151** (not shown isolated) is configured identically as the front nutating axle **135** as shown in FIG. **10**A. The right angular extension on the rear axle is designated **138** and the left angular rear axle extension is designated as **167**.

[0065] FIG. **11** is a front view of the massage device of the first embodiment **100** with the outer casing removed. The front nutating rollers **107** and **106** are shown mounted upon the front nutating axle assembly **135** to illustrate the roller orientation when the front nutating axle is rotated to the position correlated to its extreme downward inclination.

[0066] FIG. **12** is a front isometric view of the massage device **100** with the outer casing removed in order to show the driving arrangement of the gears and axles which are attached to the main frame **116**. Front axle drive gear **126** is rotating counterclockwise as shown by arrow **145**. Pinion **122** therefore causes the tip of nutating axle extension **136** to rotate clockwise as shown by arrow **141**. Four synchronizing pinions are shown as **140**A, **140**B, **140**C and **140**D. These synchronizing pinions induce rear axle drive gear **128** to rotate clockwise as shown by arrow **143**. The clockwise rotation of gear **128** as shown by arrow **143** causes the rear axle drive pinion to rotate the tip **138** of the rear nutating axle counter clockwise as shown by arrow **139**. The front nutating axle extension **136** and the rear nutating axle extension **138** therefore counter-rotate synchronously at the same velocity as indicated by the arrows **141** and **139**. One cycle is defined as one full revolution of pinion **122** and pinon **124**. One of ordinary skill understands that a timing belt could be substituted for some of the gear train components for the purpose of providing synchronization.

[0067] The nutating motion of the front axle **136** of device **100** is illustrated in FIG. **13**. The arrow **141** shows rotation of drive pinion **122** which is fixed to front axle **136**. The tip of the front nutating axle **136** is shown in four superimposed positions **136**A thru **136**D. Using the analogy of a clock, position **136**A illustrates the relative position of the axle tip **136** when the axle is positioned at its 6 o'clock position. The position **136**B shows the 9 o'clock position, while **136**C shows the 12 o'clock position and **136**D shows the 3 o'clock position as the tip moves thru a clockwise circle. The left side of the front nutating axle moves simultaneously thru the same circular path, as explained by the orbits shown in FIG. **10**B. The right tip motion is said to be "in phase" with the left tip motion because each tip passes thru the same rotational phase of their circles simultaneously during each cycle. For example, each of the two axle tips will arrive at its 12 o'clock position simultaneously as it traverses its nutation circle. The motion of the two nutating extremities of the front axle is similar to the motion of a human swimmer's arms while doing the butterfly stroke. There is a difference however, in that the tips of the nutating axle move synchronously through a perfect circle.

[0068] FIG. **14** illustrates the synchronized motion between the front nutating axle **136** and the rear nutating axle **138**. At the moment that the front nutating axle **136** is at its 6 o'clock position **136**A, the rear nutating axle is at its 6 o'clock position **138**A. Likewise, when front nutating axle is at its 12 o'clock position **136**C, the rear nutating axle is also at its 12 o'clock position **138**C.

[0069] However, the two nutating axles do not pass thru their 3 o'clock positions simultaneously. FIG. **15** illustrates that the synchronized motion of the two nutating axles induces them to move in opposite directions relative the X axis during a portion a revolution of the two axles. At the moment that the front nutating axle **136** is at its 3 o'clock position **136**D, the rear nutating axle is at its 9 o'clock position **138**B. The two axle tips have thus moved apart at that position in the cycle. Likewise, when the front nutating axle is at its 9 o'clock position **136**B, the rear nutating axle is at its 3 o'clock position **138**D. The two axle tips have thus moved closer together relative to the X-axis at that position in the cycle.

[0070] FIG. **16**A is a top view of the massage device **100** showing the front and rear nutating rollers at their relative extreme positions along the x-axis within the nutating cycle. The front nutating roller **106** is at its 3 o'clock position while the rear nutating roller **108** is at its 9 o'clock position. Likewise, the left front roller **107** is ats 3 o'clock position while the left rear nutating roller **109** is at its 9 o'clock position. The positions of the two nutating rollers correspond to the positions **136**D and **138**B as shown in FIG. **15**.

[0071] The label "STRETCH" in FIG. **16**A is used to indicate that a massage-receiving fascia within the region **172** between the roller **109** and **107** tends to be stretched by the opposing separating movement of those two rollers along the X-axis. The fascia region **170** between nutating roller **106** and nutating roller **108** is also synchronously stretched. As explained in reference to FIG. **6**, the X-axis corresponds to one "stretch axis" along the surface of the fascia.

[0072] In comparison to FIG. **16**A, FIG. **16**B is a top view of the massage device **100** showing the front and rear nutating rollers at their opposite relative extreme positions along the X-axis within the nutating cycle. In FIG. **16**B the two nutating rollers have rotated 180 degrees from the positions shown in FIG. **16**A. FIG. **16**B illustrates the condition where the two right rollers **106** and **108** are closest together along the stretch axis (X-axis). The same is true for the left rollers **107** and **109**.

[0073] The label "COMPRESS" in FIG. **16**B is used to indicate that the massage-receiving fascia within the region **172** between the roller **109** and **107** tends to be compressed as those two rollers move toward each other along the X-axis. The region **170** between nutating roller **106** and nutating roller **108** is also synchronously compressed. In one revolution of the synchronized nutating axles (one cycle), the fascia regions **170** and **172** between the front nutating rollers and the rear nutating rollers experiences a bidirectional cycle of stretch and compression along the X-axis.

[0074] The side elevational view in FIG. **17**A is helpful to understand the configuration of the compressed fascia as explained in the top view of FIG. **16**B. Compression along the plane of the fascia creates a bulge as shown in region **170** of FIG. **17**A. As the rollers **108** and **106** separate and move in the opposite direction, the region **170** is stretched as shown in FIG. **17**B. The side view of FIG. **17**B thus corresponds to the top view shown in FIG. **16**A.

[0075] FIG. **17**C illustrates the hands of a massage therapist while performing a technique called myofascial massage. The fascial region of the subject between the two hands of the therapist is alternately compressed and stretched as the movement is performed. The same alternating compression and stretching cycle is simulated by the eccentric rollers of the massage device disclosed herein as shown in FIG. **17**A and FIG. **17**B.

[0076] FIG. **18**, FIG. **19**, FIG. **20**, FIG. **21** and FIG. **22** illustrate a side view of the massage device **100** as the right front roller **106** and right rear roller **108** rotate through the circular sequence of positions comprising one revolution of their synchronized nutating axles.

[0077] Specifically, FIG. **18** illustrates the positions of rear roller **108** and front roller **106** as they both reside in the 12 o'clock orientation along the circular orbit that was described in FIG. **10**B. In FIG. **19**, the right front roller **106** has moved from its 12 o'clock position to its 3 o'clock position, inducing a massage force vector along the X-axis and a massage force vector along the Z-axis. The right rear roller **108** has moved from its 12 o'clock position to its 9 o'clock position, inducing a massage force vector along the X-axis and a massage force vector along the Z-axis. The arrows indicate the rotational directions of the two counter rotating axle tips. In FIG. **20**, the right front roller **106** has moved from its 3 o'clock position to its 6 o'clock position, inducing a massage force vector along the X-axis and a massage force vector along the Z-axis. The right rear roller **108** has moved from its 9 o'clock position to its 6 o'clock position, inducing an opposite massage force vector along the X-axis and a massage force vector along the Z-axis. The arrows again indicate the rotational directions of the two counter rotating axle tips.

[0078] FIG. **21** illustrates the stage wherein the right front roller **106** has moved from its 6 o'clock position to its 9 o'clock position, inducing a massage force vector along the X-axis and a massage force vector along the Z-axis. The right rear roller **108** has moved from its 6 o'clock position to its 3 o'clock position, inducing a massage force vector along the X-axis and a massage force vector along the Z-axis. The arrows again indicate the rotational directions of the two counter rotating axle tips.

[0079] FIG. **22** illustrates the stage wherein the right front roller **106** has moved from its 9 o'clock position to its 12 o'clock position, inducing a massage force vector along the X-axis and a massage force vector along the Z-axis. The right rear roller **108** has moved from its 3 o'clock position to its 12 o'clock position, inducing an opposite massage force vector along the X-axis and a massage force vector along the Z-axis. The arrows again indicate the rotational directions of the two counter rotating axle tips.

[0080] The rollers **106** and **108** are shown in their 12 o'clock position in FIG. **22**. The two arcs **158** and **159** in FIG. **22** represent the extreme lower periphery of rollers **106** and **108** when located at their 6 o'clock position. The dimension **159** thus represents the range of motion traversed by these rollers as projected upon the Z-axis, which creates the percussive force component of the nutating massage device.

[0081] The nutating axle motion additionally creates massage force vectors along the Y-axis (as shown at least within FIG. **6**). FIG. **23** is a front view of the massage device **100** showing the two front nutating rollers. This figure illustrates the massage force vectors **180** and **182** being created in the regions **168** and **169** beneath the rollers and orthogonal to the X-axis axis, as the two front nutating rollers **106** and **107** move toward the 12 o'clock zeniths along their nutating circle orbit. The opposing outward motions in directions **180** and **182** cause the fascia region **187** to stretch along the Y-axis.

[0082] FIG. **24** is a front view of the massage device showing the two front nutating rollers and illustrates the massage force vectors **181** and **183** being created in the contact regions **168** and **169** along the Y-axis, as the two front nutating rollers **106** and **107** move toward the lowest 6 o'clock position along the nutating circle orbit. The opposing inward motions in directions **181** and **183** cause the fascia region **187** to compress along the Y-axis. One rotational cycle of each nutating roller thus produces bidirectional massage force vectors outward (**180** and **182**) and then inward (**181** and **183**) along the Y-axis.

[0083] Thus, 3-dimensional massage forces are created along the X, Y, and Z-axes under the contact region of each of the four rollers during one revolution (one cycle) of the two synchronized nutating axle assemblies **135** and **151**. Each fascia contact region **168** and **169** thus experiences a bidirectional reciprocating pulsation along each of the X, Y and Z orthogonal axes during each cycle. These reciprocating forces are imposed whether or not the device is traversed along the massage-receiving fascia surface.

[0084] FIG. **17**A and FIG. **17**B illustrate the reciprocating stretching and compression of the fascia along the X-axis. FIG. **23** and FIG. **24** illustrate the reciprocating stretching and compression of the fascia along the Y-axis. FIG. **22** illustrates the range of reciprocating percussive motion upon the fascia along the Z-axis. Collectively, these figures illustrate how the nutating massage device uniquely induces reciprocating massage forces along all three axes X, Y and Z.

[0085] A second embodiment of a nutating massage device is shown in FIG. **25**. Massage device **200** includes two massage rollers which are rotatably mounted on nutating axles and two rollers which are mounted on a non-nutating axle. The device **200** consists of a casing body **201**

which includes a handle portion **204**. The front rollers **206** and **207** are driven by a first nutating axle (the front axle) and the rear rollers **208** and **209** (not shown) are freely rotatable on a non-nutating rear axle which is fixedly attached to the device frame. The speed of the nutating axle motion is controlled by the velocity of a drive motor mounted internally within the casing **201**. The operator controls the motor speed by setting the position of the speed control knob **202**. The reference axes X, Y, and Z are shown to orient the vectors showing direction of the massage forces as further explained below. In general, the operator grasps the device by the handle portion **204** and exerts pressure along the negative Z axis. The user may traverse the massage device back and forth along the massage-receiving surface in the direction of the X axis, or hold the device in a stationary position at a specific target region.

[0086] The second embodiment massage device **200** is a variation of the first embodiment with a lessor manufacturing cost and longer battery life arising from the elimination of some drive components. Only one of two axles are motor-driven. The massage device **200** is shown in FIG. **26** where the outer casing is removed to illustrate the components attached to main frame **216**. The electronics **218** for the motor control and charging circuitry are mounted just in front of the batteries **220** that power the motor. The batteries could be of the NICAD, lithium ion, sodium ion or other known battery types. The trigger button and charging port (not shown) are identical to those explained in the first embodiment (FIG. **7**). The front nutating axle **236** is driven from gear **226** via pinion **222**. A drive motor and worm gears (not shown) are mounted upon the left side of main frame **216**, and rotate the drive gear **226**. Rear axle **238** is a non-nutating shaft which is fixedly attached to main frame **216**. The non-nutating fixed axle **238** may have the same angular bend portions as the nutating axle, or may have no bends.

[0087] When the massage device **200** is activated by its trigger button, the drive motor rotates the front nutating axle **236**, creating the nutating rotation of the front massage rollers. The rear massage roller pair freely rotates upon fixed axle **238** and provides stability for the device in the application whereupon the device is traversed along the massage-receiving surface. As explained in the disclosure of the first embodiment, the two front nutating rollers each induce a 3-dimensional massage force vector in the contact region directly beneath each roller. The role of the axles in the second embodiment may be reversed, such that the rear rollers nutate and the front rollers may be fixedly attached to provide stabilization.

[0088] A third embodiment of a nutating massage device **250** is shown in FIG. **27**. This embodiment is designed as a lower manufacturing cost alternative to the second embodiment, where only one nutating axle is driven, thus eliminating the manufacturing costs of the synchronizing gear train components. Additionally, the third embodiment eliminates the speed control means and it accompanying circuitry, thus further reducing manufacturing cost. This embodiment operates at a fixed motor speed, so that its housing can be made slimmer and more compact than the configuration of the first embodiment. The nutating massage device **250** in FIG. **27** possesses a slimmer housing **251** with a handle portion **254**, but is devoid of any user-adjustable speed control. The rear rollers **258** and **259** are mounted on nutating axles which are motor-driven in the same way as explained in the first embodiment. Front rollers **256** and **257** are mounted on a fixed axle **136** as shown in FIG. **10***a* which does not rotate. Rollers **256** and **257** rotate freely upon axle **136** to provide stability during traversing motion of device **250**.

[0089] A fourth embodiment of a nutating massage device **300** is shown in FIG. **28**. Massage device **300** includes four massage rollers which are rotatably mounted on two nutating axles. The device **300** consists of a casing body **301** which includes a handle portion **304**. The front rollers **306** and **307** are driven by a first nutating axle (the front axle) and the rear rollers **308** and **309** (not shown) are driven by a second nutating axle (the rear axle) The speed of the nutating axle motion is controlled by the velocity of a drive motor mounted internally within the casing **301**, and the operator controls the motor speed by setting the position of the speed control knob **302**. The reference axes X, Y, and Z are shown to orient the vectors showing direction of the massage forces as further explained below. In general, the operator grasps the device by the handle portion **304** and exerts pressure along the negative Z axis. The user may traverse the massage device back and forth along the massage-receiving surface in the direction of the X axis, or the user may hold the device stationary against a specific target region.

[0090] The configuration of the nutating axles used in the fourth embodiment is different than the nutating axles used in the first, second and third embodiments. FIG. **29**A shows the configuration of the front nutating axle assembly **335** which is used in the fourth embodiment. The axle rotates within bearings **323** about axis **325**, as driven by pinion **322** which is fixedly attached to the axle assembly **335**. The left angular axle extension **336** is bent at an angle **327** which is called the mitating angle. The right angular axle extension **337** is bent into a nutating angle **328** which is in the opposite angular direction as the left axle extension. The left and right nutating angles **327** and **328** are shown to be equal in a preferred embodiment of axle assembly **335**, but this embodiment may be implemented with unequal nutating angles.

[0091] FIG. **29**B is a diagram explaining the phase relationship between the right and left nutating axle tips according to the axle configuration of FIG. **29**A. The wire **325** represents the rotational axis of the axle as shown in in FIG. **29**A, while the circles **358** and **360** represent the circular paths (exaggerated) of the axle tip extremities. Nutation circle **358** represents the loci of the path of the right nutating axle tip orbit, while nutating circle **360** represents the orbital path of the left nutating axle tip. Label **362** indicates the position of the right axle tip along its nutation circle at any given point in time, while **364** represents that of the left axle tip. In this example, the right axle tip **362** is at its 2 o'clock position while the left axle tip **364** is also it its 8 o'clock position. In the analogy of a clock, axle tip **364** is 6 hours ahead (180 degrees) of axle tip **362**. The angular relationship between the two axle tips is said to be "180 degrees out of phase" because one axle tip remains 180 degrees away from the other along their nutation circles at any given instant in time. At the moment in time when one axle tip is at 3 o'clock, the other axle tip is at its 9 o'clock position.

[0092] The nutation circles **358** and **360** formed by the left tip and right tip will be aligned when looking along the rotation axis **325** of axle assembly **335**. However, the angular phase of the axle tips along the nutation circles will be out of phase by 180 degrees. The overall motion of the front nutating axle can be envisioned as similar to the motion of a human swimmer doing the overarm freestyle, as one arm rotates forward while the opposite arm rotates rearward. There is a difference however in that the tips of the nutating axle move through a perfect circle.

[0093] FIG. **30** is a top view of the massage device **300** with the massage rollers removed from the nutating axles. Rear nutating axle assembly **394** (not shown) is identical to the configuration of the front nutating axle **335** which was shown in FIG. **29**A. However, the angular orientation of the two axles are set up at assembly to be exactly opposite. Also, the synchronizing gear train from the first embodiment (see FIG. **12**) is identically utilized in this fourth embodiment. In this way, the rotational velocities of the front and rear nutating axles are identical and their motion is synchronized.

[0094] In the illustration of FIG. **30**, the right extension **336** of nutating axle assembly **335** is located at its 3 o'clock position and synchronized with the right extension **338** of the rear nutating axle when located at its 9 o'clock position. The result is that the left extension **336** of nutating axle **335** is simultaneously located at its 9 o'clock position when viewing the front axle from the right side. Similarly, the right extension of the rear axle **338** is 180 degrees out of phase with the right tip of that axle. When viewed from above, the X-axis vector arrows indicate that the right axle extensions have just moved away from each other as the left axle extensions have just moved toward each other.

[0095] FIG. **31** is a top view of massage device **300** that is identical to FIG. **30**, with the exception that the freely rotatable nutating rollers are installed on the nutating axles. Right front roller **306** is located in its 3 o'clock position and synchronized with the right rear nutating roller **308** when located at its 9 o'clock position. At this point in the nutating cycle those two rollers have reached their extreme distance from each other, and have induced a stretching force along the stretching axis in the fascia region **370** between roller **308** and roller **306**.

[0096] Simultaneously, the left rear roller **309** and the left front roller **307** have reached the position in the nutation cycle where they are closest to each other along the X-axis. The symbol "COMPRESS" in FIG. **31** indicates that the fascia region **372** between roller **307** and roller **309** tends to become compressed as those two rollers move towards each other.

[0097] During the successive portion of each cycle, the relative motion of the left and right rollers along the X-axis is reversed as shown in FIG. **32** which shows a top view of the massage device **300**. The position of the two nutating axles is rotated by 180 degrees when compared to FIG. **31**, such that front right roller **306** is located at its 9 o'clock position and right rear roller **308** is located at its 3 o'clock position. At this point in the nutating cycle, roller **306** has moved closest to roller **308** along the X-axis. Simultaneously, the left side rollers **307** and **309** are 180 degrees out of phase, and those two rollers have moved to a position with the most separation from each other.

[0098] FIG. **31** and FIG. **32** together explain that the stretching and compression cycles along the surface of the fascia are alternatingly reversed from side to side of the device in the fourth embodiment of the nutating massage device **300**. These figures can be compared to FIG. **16**A and FIG. **16**B of the first embodiment. In that first embodiment, the stretching and compression cycles induced by the left and right roller pairs did not alternately reverse from side to side.

[0099] FIG. **33** illustrates a fifth embodiment of a nutating massage device designated as device **400**. Massage device **400** includes two massage rollers which are rotatably mounted on one nutating axle and two rollers which are mounted on one non-nutating axle. The device **400** consists of a casing body **401** which includes a handle portion **404**. The front rollers **406** and **407** are driven by a first nutating axle (the front axle) and the rear rollers **408** and **409** (not shown) are freely rotatable on a fixed rear axle which is not rotatable. The speed of the nutating axle motion is controlled by the velocity of a drive motor mounted internally within the casing **401**, and the operator controls the motor speed by setting the position of the speed control knob **402**. The reference axes X, Y, and Z are shown to orient the vectors showing direction of the massage forces as further explained below. In general, the operator grasps the device by the handle portion **404** and exerts pressure along the negative Z axis. The user may traverse the massage device back and forth along the massage-receiving surface in the direction of the X axis, or the user may hold the device stationary against a specific target region.

[0100] The massage device **400** is shown in FIG. **34** where the outer casing is removed to illustrate the components attached to main frame **416**. The electronics **418** for the motor control and charging circuitry are mounted just in front of the batteries **420** that power the motor. The batteries could be of the NICAD, lithium ion, sodium ion or other known battery types. The trigger button and charging port (not shown) are identical to those explained in the first embodiment (FIG. **7**). The front nutating axle assembly **335** is identical to that shown in FIG. **29**A, and is driven from gear **426** via pinion **322**. A drive motor and worm gears (not shown) are mounted upon the left side of main frame **416**, and rotate the drive gear **426**. Rear axle **438** is a non-rotatable shaft which is fixedly attached to main frame **416**.

[0101] When massage device **400** is activated by its trigger button, the drive motor rotates the front nutating axle assembly **335**, creating the nutating rotation of the front massage rollers **406** and **407** which rotate 180 degrees out of phase. The rear massage rollers **408** and **409** freely rotate upon fixed axle **438** and provide stability for the device in the application whereupon the device is traversed along the massage-receiving surface. As explained in the disclosure of the first embodiment, the two front nutating rollers each induce a 3-dimensional massage force vector in the contact region directly beneath each roller. The role of the axles in the fourth embodiment may be reversed, such that the rear rollers nutate and the front rollers are utilized for stabilization.

[0102] Variations of these embodiments may be apparent to one of ordinary skill. A second drive motor could be utilized in the first and fourth embodiments such that the synchronizing gears **140**A, **140**B, **140**C and **140**D could be eliminated. In that variant, the electronic controller is utilized to synchronize the phase of each motor, such that the same 3-dimensional massage force vectors are induced as were explained in the first and fourth embodiments.

[0103] Accordingly, it is to be understood that the embodiments of the invention herein described are merely illustrative of the application of the principles of the invention. Reference herein to details of the illustrated embodiments is not intended to limit the scope of the claims, which themselves recite those features regarded as essential to the invention.

1. A handheld, self-powered freely traversable massage device having a first non-traversing mode and a second traversing mode, the device comprising;

a casing including a handle portion;

a rechargeable battery pack;

one motor located within the casing;

an operator-adjustable motor speed control mechanism;

an operator controlled activation switch;

four rollers each rotating freely upon its own axle and comprising a front roller pair and a rear roller pair;

a first roller and a second roller comprising the front roller pair while the rear roller pair is comprised of a third roller and a fourth roller;

the first roller and the third roller oriented external to the casing on the casing's right peripheral side and comprising a right roller pair;

the second roller and the fourth roller oriented external to the casing on the casing's left peripheral side and comprising a left roller pair;

the axle of the first roller and the axle of the second roller rigidly adjoined at the opposing ends of a first motor-driven axle and extending angularly therefrom, causing the roller axles to orbit conically about the first motor-driven axle;

the axle of the third roller and the axle of the fourth roller rigidly adjoined at the opposing ends of a second motor-driven axle and extending angularly therefrom, causing the roller axles to orbit conically about the second motor-driven axle;

the conical orbits of the front roller axles and the conical orbits of the rear roller axles causing the front roller pair and the rear roller pair each to synchronously nutate about their motor-driven axles as the motor continuously rotates;

each roller axle orbit comprising a 360 degree excursion along a nutation circle formed by the loci of the distal end of each roller axle, the axis of each nutation circle being coincident with the rotation axis of its motor-driven axle;

each roller having an outer surface in continuous rolling contact with an independent area of the fascia during each roller axle orbit while the device is positioned stationary in the first non-traversing mode;

the right roller pair configured to bear upon a first fascia region comprising the region between the right roller pair;

the left roller pair configured to bear upon a second fascia region comprising the region between the left roller pair;

the motor-driven axles being angularly phased such that the center distance between the right roller pair and the center distance between the left roller pair each expand and contract cyclically as the motor continuously rotates;

the expanding and contracting center distance between each roller pair producing continuously reciprocating roller oscillation configured to bear upon the first and the second fascia regions;

each roller producing one reciprocation cycle in each of three axes during each nutation orbit, including:

1) a first reciprocation axis (X-axis) upon a fist plane being parallel to the fascia surface and directed along that plane perpendicular to its motor-driven axle axis, and

2) a second reciprocation axis (Y-axis) upon a second plane being parallel to the fascia surface and directed along that plane parallel to its motor-driven axle axis;

3) a third reciprocating axis (Z-axis) upon a third plane being perpendicular to the fascia surface and directed along that plane perpendicular to the fascia surface, and

the motor continuously producing reciprocating contact upon each of the first fascia region and the second fascia region including percussive forces along the third axis and stretching forces along the first and second axes simultaneously while the device is positioned stationary in the first non-traversing mode;

wherein the continuously reciprocating roller motion upon the first fascia region is synchronized with the oppositely directed reciprocating roller motion upon the second fascia region while the device is positioned stationary in the first non-traversing mode, and at a rate proportional to the operator-controlled motor speed.

2. The massage device of claim **1**, whereupon the axle of the first roller and the axle of the second roller rotate synchronously in phase through identical nutating circles.

3. The massage device of claim **1** whereupon the axle of the third roller and the axle of the fourth roller rotate synchronously in phase through identical nutating circles.

4. The massage device of claim **1** wherein a rotational velocity of the first motor-driven axle is the same as a rotational velocity of the second motor-driven axle.

5. The massage device of claim **1** whereupon the first motor-driven axle and the second motor-driven axle are driven by the same motor.

6. The massage device of claim **1** whereupon synchronizing gears are used to synchronize a rotation of the second motor-driven axle in respect to a rotation of the first motor-driven axle.

7. The message device of claim **1** whereupon the second motor-driven axle synchronously counter-rotates relative to the first motor-driven axle.

8. The massage device of claim **1** whereupon a 3 o'clock position of the first roller is synchronized to a 9 o'clock position of the fourth roller.

9. The massage device of claim **8** whereupon the expanding center distance between the right roller pair and expanding center distance between the left roller pair act to induce a stretching force upon the surfaces of the first fascia region and the second fascia region.

10. The massage device of claim **1** whereupon a rotational velocity of the first motor-driven axle is different than a rotational velocity of the second motor-driven axle.

11. The massage device of claim **1** whereupon the first motor-driven axle is driven by a first continuously rotating motor, and the second motor-driven axle is driven by a second continuously rotating motor.

12. A handheld, self-powered freely traversable massage device having a first non-traversing mode and a second traversing mode, the device comprising;

a casing including a handle portion;

a rechargeable battery pack;

one motor located within the casing;

an operator-adjustable motor speed control mechanism;

an operator controlled activation switch;

four rollers, each rotating freely upon its own axle and comprising a front roller pair and a rear roller pair;

a first roller and a second roller comprising the front roller pair while the rear roller pair is comprised of a third roller and a fourth roller;

the first roller and a third roller oriented external to the casing on the casing's right peripheral side and comprising a right roller pair;

the second roller and a fourth roller oriented external to the casing on the casing's left peripheral side and comprising a left roller pair;

the third roller and the fourth roller sharing a non-nutating axle that is fixed non-rotatably to the casing at the section between the two rollers;

the axle of the third roller and the axle of the fourth roller rigidly adjoined at the opposing ends of a motor-driven axle and extending angularly therefrom, causing the roller axles to orbit conically about the motor-driven axle;

the conical orbits of the rear roller axles causing the rear roller pair to synchronously nutate about the motor-driven axle as the motor continuously rotates;

each roller axle orbit comprising a 360 degree excursion along a nutation circle formed by the loci of the distal end of each roller axle, the axis of each nutation circle being coincident with the rotation axis of its motor-driven axle;

each roller of the rear roller pair having an outer surface in continuous rolling contact upon the fascia during each roller axle orbit while the device is positioned stationary in the first non-traversing mode;

the right roller pair bearing upon a first fascia region comprising the region between the right roller pair;

the left roller pair bearing upon a second fascia region comprising the region between the left roller pair;

the orbiting rollers of the motor-driven axle alternately expanding and contracting the center distance between the right roller pair and the center distance between the left roller pair;

the orbiting rear roller pair producing continuous reciprocating roller motion perpendicular to the fascia surface resulting in percussive massage forces in each of the first fascia region and the second fascia region which are oppositely directed along the X-axis while the device is positioned stationary in the first non-traversing mode.

13-17. (canceled)

18. The massage device of claim **1** whereupon the massage device induces continuous reciprocating massage forces upon two adjacent fascia regions when operating in either the first stationary mode or the second freely traversable mode.

19. (canceled)

20. A method of utilizing a self-powered motor-driven massage device comprising two pairs of nutating rollers, each pair having motorized expanding and contracting center distances to produce alternating stretching and compression of the fascia in two separated fascia regions simultaneously at an operator-controlled cyclic rate while the device is held stationary in a non-traversing mode;

the method comprising the steps of grasping the device by the handle, positioning the device against the fascia, setting the motor speed, depressing the actuation switch, and holding the device steady with contact upon the two adjacent fascia regions while the roller center distance of each roller pair alternately expands and contracts independently upon each of the adjacent fascia regions.

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