

(19) **DANMARK**

(10) **DK/EP 2480301 T3**



(12)

Oversættelse af europæisk patentskrift

Patent- og
Varemærkestyrelsen

-
- (51) Int.Cl.: **A 63 H 11/02 (2006.01)** **A 63 H 17/26 (2006.01)** **A 63 H 29/22 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2015-10-12**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2015-07-08**
- (86) Europæisk ansøgning nr.: **10766167.0**
- (86) Europæisk indleveringsdag: **2010-09-24**
- (87) Den europæiske ansøgnings publiceringsdag: **2012-08-01**
- (86) International ansøgning nr.: **US2010050258**
- (87) Internationalt publikationsnr.: **WO2011038268**
- (30) Prioritet: **2009-09-25 US 246023 P**
- (84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR**
- (73) Patenthaver: **Innovation First, Inc., 1519 Int. 30 W., Greenville, TX 75402, USA**
- (72) Opfinder: **NORMAN, David Anthony, 3056 Old Mill Road, Greenville, Texas 75402, USA**
MIMLITCH, III, Robert H., 5606 Luna Dr., Rowlett, Texas 75088, USA
CARTER, Joel Reagan, 315 Dove Creek Rd., Argyle, Texas 76226, USA
GALLETTI, Douglas Michael, 439 Deer Brooke Dr., Allen, Texas 75002, USA
- (74) Fuldmægtig i Danmark: **RWS Group, Europa House, Chiltern Park, Chiltern Hill, Chalfont St Peter, Bucks SL9 9FG, Storbritannien**
- (54) Benævnelse: **KØRETØJ, SÆRLIGT SELVOPRETTENDE LEGETØJSROBOT MED VIBRATIONSMOTOR**
- (56) Fremdragne publikationer:
FR-A- 1 564 711
FR-A1- 2 358 174
GB-A- 2 427 529
JP-A- 4 030 883
US-A- 4 219 957
US-B1- 6 899 589

DESCRIPTION

FIELD OF THE INVENTION

[0001] The present invention relates to a vehicle with a vibration drive, in particular, a toy robot with a vibrating motor and several legs, wherein the toy robots resemble small, living, crawling animals or beetles.

BACKGROUND OF THE INVENTION

[0002] In the prior art, vehicles with vibrating motors are known that are designated by those skilled in the art, in general, as "vibrobots." One special form of "vibrobot" is the so-called "bristlebot" that consists of a toothbrush head that has been cut off, a battery, and a vibrating motor. The "bristlebot" is supported on the ground with the bristles of the toothbrush head; the bristles thus correspond, to a certain extent, to the legs of a "bristlebot." Both the battery and also the vibrating motor are arranged on top of the toothbrush head. Due to the vibration, the entire toothbrush head is set into vibration, so that the "bristlebot" can move forward. Such "bristlebots" are known from FR 1 564 711 A, FR 2 358 174 A1 und US 4 219 957 A.

[0003] The type of forward movement and the mechanical properties of the "bristlebot," however, are rather unsatisfactory in many respects. For one, a "bristlebot" does not appear just like a living beetle from the viewpoint of a user or another person, but instead only like a vibrating toothbrush head.

[0004] A further "bristlebot" design is known from GB 2 427 529 A. This "bristlebot" has the shape of an egg with two toothbrush heads serving legs. This "bristlebot" does also not appear like a living beetle but rather like a walking egg.

[0005] US 6 899 589 B1 discloses a hopping toy robot having the shape of a Tigger. This toy Tigger comprises a vibration drive and vertical legs comprising springs.

SUMMARY OF THE INVENTION

[0006] The present invention relates to a vehicle according to Claim 1. The dependent claims relate to advantageous constructions of the present invention.

[0007] The vehicle of the present invention has a plurality of legs and a vibration drive. In the present invention, "vehicle" is meant to be any type of moving robot, in particular, a toy robot in general and toy robots that have the shape of a beetle or some other animal, insect, or reptile.

[0008] According to one aspect of the invention, the legs of the vehicles could be angled or curved and flexible. The vibrating motor could generate a force (F_v) that is directed downward and is suitable for deflecting at least the front legs, so that the vehicle moves forward. The legs of the vehicle are advantageously inclined in a direction that is offset from the vertical. The bases of the legs are thus arranged farther forward on the vehicle relative to the tips of the legs. In particular, the front legs are adapted to deflect when the vehicle vibrates due to the vibrating motor. Conversely, the vibrating motor could also generate a force (F_v) that is directed upward and is suitable for making the vehicle hop or for lifting the front legs from the ground surface.

[0009] According to another aspect of the invention, the geometry of the back legs could be constructed such that a different braking or dragging effect is achieved. In other words, the geometry of the back legs could be constructed such that the tendency for rotation due to the vibration of the vibrating motor is counteracted. The rotating, eccentric weight moves during the lifting of the front legs in the lateral direction, with respect to the longitudinal axis of the vehicle, such that without countermeasures, the vehicle would move along a curve. Countermeasures can be achieved in various ways: more weight could be shifted to one front leg in comparison to the other front leg. The length of a back leg could be increased in comparison to the other back leg. The stiffness of the legs could be increased on one side in comparison to the legs on the other side. A back leg could have a thicker construction in comparison to the other back legs on the other side. One of the back legs could be arranged farther forward than the other back leg.

[0010] According to another aspect of the invention, the vehicle could be constructed to rotate and to right itself by the effect of

the rotating torque of the vibrating motor. This can be achieved, for example, in that the center of gravity of the body or of the vehicle is positioned close to or on the axis of rotation of the vibrating motor. In addition, the sides and the top side of the vehicle could be constructed to allow the self-righting of the vehicle during the vibration. Thus, a high point could be provided on the top side of the vehicle, so that the vehicle cannot lie completely upside down on its back. However, fins, plates, or flippers could also be arranged on the sides and/or on the back of the vehicle, with their outer points advantageously arranged close to or on a virtual cylinder.

[0011] According to another aspect of the invention, the legs could be arranged in two rows of legs, wherein there is a space, in particular, a V-shaped recess, between the body of the vehicle and the legs of the vehicle, so that the legs can bend inward during a righting rotation. In this way, the righting movement of the vehicle is simplified if it should topple over. Advantageously, the legs are arranged in two rows of legs as well as to the side and above the axis of rotation of the vibrating motor.

[0012] According to another aspect of the invention, the vehicle could have an elastic nose or an elastic front part, so that the vehicle rebounds when impacting an obstacle. The elastic nose or the elastic front part is advantageously constructed from rubber. In addition, the elastic nose or the elastic front part advantageously has a construction running to a point. In this way, the vehicle could more easily avoid an obstacle, without the use of a sensor or some other control for a steering motion.

[0013] According to another aspect of the invention, the vibration drive could have a motor and an eccentric weight, wherein the eccentric weight is arranged in front of the front legs. In this way, a reinforced lifting movement of the front legs is achieved, wherein the back legs remain as much as possible on the ground (but may also bounce slightly). In particular, the eccentric weight is arranged in front of the motor. In addition, a battery is advantageously arranged on the rear part of the vehicle, in order to increase the weight on the back legs. Both the battery and the motor are advantageously arranged between the legs. The axis of rotation of the motor can run along the longitudinal axis of the vehicle.

[0014] According to the principles of the present invention, the vehicle could thus be constructed with a vibrating motor, and could copy an organic life form, in particular, a living beetle or other small animal, with respect to advancing speed, stability of the forward motion, tendency to roam, ability to right itself, and/or individuality.

[0015] The present invention can be a device, in particular, a vehicle or a toy robot with a vibration drive that pursues one or more of the following goals:

1. 1. Vehicle with vibrating motor with flexible legs in varied configuration;
2. 2. Maximizing the vehicle speed;
3. 3. Changing the predominant direction of motion of the vehicle;
4. 4. Preventing the overturning of the vehicle;
5. 5. Production of vehicles that can right themselves;
6. 6. Generating a movement that resembles living animals, in particular, beetles, insects, reptiles, or other small animals;
7. 7. Generating multiple modes of movement, so that the vehicles differ visibly in their movement, in order to provide many different vehicle types;
8. 8. Generating apparent intelligence when obstacles are encountered.

[0016] These aspects, and how they are achieved, are explained in detail in the following detailed description in connection with the figures.

BRIEF DESCRIPTION OF THE FIGURES

[0017]

Figures 1a and 1b show a vehicle or a toy robot according to a first embodiment of the present invention;

Figures 2a-2f show general forces that can act generally on a vehicle or a toy robot according to one embodiment of the present invention (Figure 2c shows the view from the front);

Figures 3a-3c show vehicles or toy robots according to various other embodiments of the present invention in which the construction of the legs has been modified;

Figures 4a and 4b show a vehicle or a toy robot according to another embodiment of the present invention in which the back legs are adjustable;

Figure 5 shows a vehicle or a toy robot according to another embodiment of the present invention with a flexible nose;

Figures 6a and 6b show the vehicle or the toy robot of the first embodiment;

Figure 7 shows a vehicle or a toy robot according to another embodiment of the present invention in which additional fins, plates, or flippers are arranged.

DETAILED EXPLANATION OF THE INVENTION

[0018] Figures 1a and 1b show a vehicle or a toy robot according to a first embodiment of the present invention.

[0019] A vibration-driven vehicle 100, such as, e.g., a miniature toy robot, could have a body with two or more legs 104 that are adapted to bend when the vehicle vibrates in a way that results in a tendency for the vehicle to move in a certain direction. For example, the legs could bend or be inclined in a direction that is offset somewhat from the vertical and could be made from a bendable or deflectable material. The body of the vehicle could include a motor in order to generate vibrations and could have a relatively low center of gravity. The shape of the top side of the body could project, in order to simplify the self-righting of the vehicle during the vibrations. The geometry of the trailing (i.e., rear) legs could be constructed such that (e.g., with respect to length or thickness of the legs) a different braking or dragging effect is achieved, in order to counteract a tendency for rotation due to the vibration of the motor or to cause a tendency for rotation in a certain direction. If multiple legs are used, some legs (e.g., those that are arranged between the front "drive" legs and the rear "drag" legs) could have a somewhat shorter construction, in order to prevent an additional braking or dragging effect.

[0020] Figures 2a-2f show general forces that could act in general on a vehicle or a toy robot according to one embodiment of the present invention (Figure 2c shows the view from the front).

[0021] The motor rotates an eccentric weight that generates a torque and force vector as shown in Figures 2a-2d. If the vertical force F_v is negative (i.e., directed downward), then this has the effect that the legs that could be angled and/or curved are deflected and the body of the vehicle up to the leg section touching the surface moves forward. If the vertical force F_v is positive (i.e., directed upward), then this has the effect that the vehicle starts hopping, so that the front legs are lifted from the ground surface and the legs can be restored to their normal geometric shape (i.e., without additional bending by the effect of an external force). During this movement, some legs, in particular, the two back legs, slide only afterward and do not hop. The oscillating, eccentric weight can rotate several hundred times per second, so that the vehicle vibrates and moves in a direction directed, in general, forward.

[0022] The rotation of the motor also causes a sideways-directed vertical force F_h (see Figures 2b and 2c) that is directed in one direction (either to the right or to the left) when the nose of the vehicle is raised, and is directed in the other direction when the nose of the vehicle is pressed downward. The force F_h causes or has the tendency to further rotate the vehicle when the nose of the vehicle is raised. This phenomenon could cause a rotating motion; in addition, different movement characteristics could be manipulated, in particular, the speed, the predominant direction of movement, a tilt, and a self-righting process.

[0023] One important feature of the leg geometry is the relative position of the "base" of a leg (i.e., the part of the leg that is attached on the body, thus, to a certain extent, the "hip joint") relative to the tip of the leg (i.e., the other end of the leg touching the surface of the ground). By varying the construction of the flexible legs, the movement behavior of the vehicle can be changed.

[0024] The vehicle moves in a direction according to the position of the base of the leg that is arranged in front of the position of the tip of the leg. If the vertical force F_v is negative, then the body of the vehicle is pressed downward. Therefore, the body is tilted so that the base of the leg rotates about the tip of the leg and toward the surface, so that the body moves, in turn, from the tip of the leg to the base of the leg. In contrast, if the base of the leg is arranged vertical above the tip of the leg, then the vehicle merely hops and does not move in a general (vertical) direction.

[0025] A curved construction of the leg emphasizes the forward movement by increasing the deflection of the leg in comparison to a straight leg.

[0026] The vehicle speed can be maximized in various ways. The increase in the vehicle speed is significant for improving the visual perception of the product that should resemble a beetle, an insect, or a reptile, such that it actually acts like a living creature. Factors that influence the speed are the vibration frequency and amplitude, the leg material (e.g., lower friction of the back legs causes higher speed), the leg length, the leg deflection properties, the geometry of one leg relative to another leg, and the number of legs.

[0027] The vibration frequency (i.e., the rotating speed of the motor) and the vehicle speed are directly proportional. That is, when the oscillation frequency of the motor is increased and all of the other factors remain constant, the vehicle will move more quickly.

[0028] The material of the legs has several properties that contribute to the speed. The friction properties of the legs determine the contribution of the braking or dragging force acting on the vehicle. Because the material of the legs can increase the coefficient of friction relative to a surface, in this case the braking or dragging force of the vehicle is also increased, so that the vehicle becomes slower. Therefore it is important to select a material with low coefficients of friction for the legs, in particular for the back legs. For example, polystyrene-butadiene-styrene with a durometer value of approximately 65 is suitable. The properties of the material for the legs also contribute-as a function of the leg thickness and leg length-to the stiffness, which ultimately determines how much hopping effect a vehicle will display. If the total stiffness of the legs increases, the speed of the vehicle will also be higher. In contrast, longer and thinner legs reduce the stiffness of the legs, so that the speed of the vehicle will be lower.

[0029] If the braking or dragging force (or the braking/dragging coefficient) of the back legs-corresponding to the measures named above-is now reduced, in particular in comparison to the front or drive legs, then the speed will increase considerably, because only the back legs develop a braking or dragging force.

[0030] The predominant direction of motion of the vehicle can be influenced in various ways. In particular, the direction of movement can be adjusted by the weight load on certain legs, the number of legs, the arrangement of the legs, the stiffness of the legs, and the corresponding braking or dragging coefficient.

[0031] The natural, laterally-acting force F_h causes the vehicle to rotate (see Figures 2b, 2c and 2d). If the vehicle is to move straight ahead, then this force must be canceled. This can be achieved by the leg geometry and by a suitable selection of the materials for the legs.

[0032] As shown in Figures 2c and 2d, with its eccentric rotating weight, the motor generates a (somewhat obliquely directed) speed vector V_{motor} whose lateral component is induced by the laterally-acting force F_h (Figure 2c shows the effect of the force from the front view of the vehicle). If this direction of movement is to be changed, then one or more of the reaction forces F_1 to F_4 (see Figure 2d) acting on the legs must induce a different speed vector. This can be achieved in the following way (alone or in combination):

1. (1) Influencing the drive vector F_1 or F_2 of the drive legs, in order to cancel out the speed vector V_{motor} : more weight could be displaced, in the case of the situation shown in Figure 2d, onto the right front leg, in order to increase the speed vector F_2 , and thus to laterally counteract the speed vector V_{motor} . (For the reverse direction of rotation of the motor leading to a speed vector pointing obliquely to the right, conversely, more weight must be displaced onto the left front leg.)
2. (2) Influencing the braking or dragging vector F_3 or F_4 , in order to cancel out the speed vector V_{motor} : this can be achieved by increasing the length of the right back leg or by increasing the braking or dragging coefficient of the right back leg in order to increase the speed vector F_4 shown in Figure 2d. (For the reverse direction of rotation of the motor leading to a speed vector pointing obliquely to the right, conversely, the left back leg must be modified accordingly.)
3. (3) Increasing the stiffness of the legs on the right side (e.g., by increasing the thickness of the legs), in order to increase the speed vectors F_2 and F_4 shown in Figure 2d. (For the reverse direction of rotation of the motor leading to a speed vector pointing obliquely to the right, conversely, the stiffness of the legs on the left side must be increased accordingly.)
4. (4) Changing the relative position of the back legs, so that the braking or dragging vector points in the same direction as the speed vector. In the case of the speed vector V_{motor} shown in Figure 2d, the right back leg must be arranged farther forward than the left back leg. (For the reverse direction of rotation of the motor leading to a speed vector pointing obliquely to the right, conversely, the left back leg must be arranged farther forward than the right back leg.)

[0033] Different measures could be used in order to prevent overturning of the vehicle or to reduce the risk of overturning (which is very large in the "vibrobots" according to the prior art):

The vehicle according to the present invention advantageously has a lowest possible center of gravity of the body (i.e., center of gravity), see Figure 2e. In addition, the legs, in particular, the right row of legs and the left row of legs, should lie relatively far apart from each other. According to the invention, the legs or the rows of legs are arranged at the side of the vehicle, in particular, at the side of the axis of rotation of the motor. In particular, the legs or the rows of legs are attached to the body of the vehicle above the center of gravity (see Figures 2c, 2e and 2f), i.e., the bases or the suspension points of the legs are each attached to the body of the vehicle above the center of gravity (see also Figure 1). With respect to the axis of rotation of the motor, the legs are attached or suspended to the side and above this axis of rotation (see Figures 2c and 2e). This allows both the motor and also the battery (and optionally a switch) to be arranged between the legs. In this way, the center of gravity of the body could be arranged very close to the ground in order to prevent the vehicle from turning over or to reduce the risk of turning over.

[0034] Furthermore, various measures could be used, so that the vehicle can automatically right itself again if it is lying on its back or on one side. This is because, despite the measures for preventing turning over, it can happen that a vehicle tips over onto its back or onto a side.

[0035] According to the invention, it can be provided that the torque of the motor is used to rotate the vehicle and to right it again. This can be achieved in that the center of gravity of the body (i.e., the center of gravity) is positioned close to or on the axis of rotation (see Figure 2f). Therefore, the vehicle has a tendency to rotate the entire body about this axis. The rotation of the body or of the vehicle here takes place opposite to the rotation of the motor.

[0036] If a tendency to rotate has been achieved by these structural measures, the outer shape of the vehicle could also be adapted such that a rotation about the axis of rotation of the body or the motor then takes place only when the vehicle is located on its back or on one side.

[0037] Therefore, a high point 120 (see Figure 1), for example, a fin, plate, or flipper 902 (see Figure 7), could be arranged on the top side, i.e., on the back of the vehicle, so that the vehicle cannot turn over completely, i.e., be rotated by 180°. In addition, projections, for example, fins, plates, or flippers 904a, 904b (see Figure 7), could be arranged laterally on the vehicle, so that the vehicle can easily rotate from the side back into its normal upright position. In this way, it is achieved that the typically horizontally-acting force F_h and the typically vertically-acting force F_v do not act parallel to the direction of the force of gravity in the turned-over state of the vehicle. Thus, the force F_h or F_v could have a righting effect on the vehicle.

[0038] As already stated, the distance of the legs or the rows of legs from each other should be as wide as possible, so that turning over is prevented as much as possible. Here, the two rows of legs could increase their distance, as shown in Figures 2c and 2e, from top to bottom, i.e., the leg suspension points (or the bases of the legs) of the two rows of legs have a smaller distance from each other than the ends of the legs (or the tips of the legs). Conversely, a space 404 (see Figure 2e) should be provided so that the legs can bend inward from the side. This space 404 that is advantageously provided between the body of the vehicle and the legs could have the shape of V-shaped recesses, i.e., the body of the vehicle is tapered, as shown in Figure 2e, from top to bottom. This space 404 allows the legs to deflect inward during a righting rotation, in order to achieve the smoothest possible transition from the side position to the stable, upright normal position.

[0039] The vehicle according to the present invention should move such that it resembles as much as possible living animals, in particular, beetles, insects, reptiles, or other small animals.

[0040] In order to achieve a most lifelike possible appearance of the movement of the vehicle in the sense of a small living animal, the vehicle should have a tendency to roam around or to wander in a serpentine-like pattern. This is because a movement along only a single direction does not appear lifelike to the user or to a third party.

[0041] Arbitrariness or randomness of the movement can be achieved, on one hand, by changing the leg stiffness, the leg material, and/or the inertia of the eccentric mass. If the leg stiffness is increased, the amount of hopping is reduced, so that random movement is reduced. Conversely, the vehicle is moved in random directions when the leg stiffness, in particular of the front driving legs in comparison to the back legs, is lower. While the material of the legs influences the stiffness of the legs, the selection of the material has yet another effect. This is because the material of the legs could be selected to attract dirt to the tips of the legs, so that the vehicle can rotate randomly or move in a different direction due to the changed sticking friction relative to the ground. The inertia of the eccentric mass also influences the randomness of the movement pattern. This is because for greater inertia, the vehicle hops with a larger amplitude and causes the vehicle to be able to impact in other relative positions relative to the ground.

[0042] Arbitrariness or randomness of the movement can be achieved, on one hand, by an elastic nose or front part 108 (see Figures 1 and 5) of the vehicle. This is because, if the vehicle collides with another object, the vehicle then rebounds in a random direction. The vehicle thus is not constantly attempting to fight against the obstacle, but instead changes its direction of movement due to the rebounding and thus can get around the obstacle. Here, no sensors are required; an apparently intelligent behavior is achieved instead by purely mechanical measures.

[0043] The nose or the front part 108 of the vehicle could have elastic properties and could be produced, in particular, from a soft material with a low coefficient of friction. A rubber with a durometer value of 65 (or less) could be used here, in order to obtain a flexible nose that could be pressed in relatively easily. In addition, the nose or the front part 108 should have a construction running to a point, so that the nose could be pressed in easier and thus promotes the springing back, so that the tip of the vehicle makes a side impact as much as possible for a new impact. The vehicle thus could be deflected in a different direction by the shape of the nose.

[0044] In addition, the properties of the legs also play a role during the impact on an obstacle. This is because if the legs are constructed so that the vehicle turns slightly about a vertical axis when there is an impact, then a movement to get around the obstacle is achieved more quickly.

[0045] Finally, the speed of the vehicle is also important for the deflection behavior when impacting on an obstacle. This is because at higher speeds, the rebound effect is larger and the likelihood that the vehicle then impacts at a different angle and can get around is thus increased.

[0046] Different leg configurations are shown in Figures 3a-3c. The forward movement points to the right in all of the figures.

[0047] In the top left diagram of Figure 3a, the legs are connected to braces. The braces are used to increase the stiffness of the legs, while keeping the appearance of a long leg. The braces could be arranged arbitrarily along the height of a leg. A different setting of the braces, in particular, the right braces opposite the left braces, is used to change the leg characteristics without having to change the leg length. In this way, an alternative possibility is created for correcting the steering.

[0048] The diagram on the top right side of Figure 3a shows a general embodiment with multiple curved legs. Take note here that the middle legs, i.e., all other legs apart from the two front legs and apart from the two back legs, could be constructed so that these do not contact the ground. In this way, the production of the legs is easier, because the middle legs can be left out of consideration for setting the movement behavior. Just the weight of the middle legs could be used optionally to set the movement behavior.

[0049] The bottom (left and right) diagrams of Figure 3a show additional attachments or projections that should impart a lifelike appearance to the vehicle. These attachments or projections vibrate together when the vehicle moves. Adjusting the attachments or projections could also be used to generate a desired movement behavior or a desired resonance behavior and in order to generate increased arbitrariness in the movement behavior.

[0050] Additional leg configurations are shown in Figure 3b. The top (left and right) diagrams show that the connection of the legs on the body can be at different positions in comparison to the embodiments that are shown in Figure 3a. In addition to the differences of the outer appearance, a higher connection of the legs on the body is used so the legs have a longer construction without here raising the center of gravity of the body (i.e., the center of gravity). In turn, longer legs have reduced stiffness, which could lead to increased hopping, in addition to other properties. The bottom diagram of Figure 3b shows an alternative embodiment of the back legs in which two legs are connected to each other.

[0051] Additional leg configurations are shown in Figure 3c. The top left diagram shows an embodiment with a minimum number of legs, namely with one back leg and two front legs. The positioning of the back leg either to the left or to the right acts like a change to a rudder, thus it is used for controlling the direction of the vehicle. If a back leg is used with a low coefficient of friction, then the speed of the vehicle is increased, as was described above.

[0052] The lower left diagram of Figure 3c shows an embodiment with three legs, wherein a single front leg and two back legs are provided. The control could be set by means of the back legs in that one back leg is arranged in front of the other back leg.

[0053] The top right diagram of Figure 3c shows a vehicle with significantly modified back legs that have an appearance like a grasshopper. The back legs lie with their bottom sides on the ground, so that the friction relative to the ground is also reduced. In addition, the vehicle is thus less influenced by unevenness or holes in the ground. The vehicle can thus slide easier over

unevenness or holes in the ground.

[0054] The bottom right diagram of Figure 3c shows a vehicle in which the middle legs are raised relative to the front and back legs. The middle legs thus primarily have an aesthetic purpose. They are also used, however, for influencing the roll-over behavior. In addition, the hopping behavior of the vehicle could also be adjusted by means of its weight.

[0055] Figures 4a and 4b show a vehicle or a toy robot according to another embodiment of the present invention in which the back legs can be adjusted in height independent of each other. The back legs could be produced from a stiff and/or flexible wire or from another suitable material, for example, from plastic. The adjustable back legs are used so that the user can adjust the movement behavior of the vehicle. In particular, the direction of movement can be adjusted, for example, from a left curve through a straight movement to a right curve.

[0056] Figure 7 shows a vehicle or a toy robot according to another embodiment of the present invention in which additional fins, plates, or flippers 902, 904a, 904b are arranged. The fins, plates, or flippers could be arranged above 902 and at the sides 904a, 904b in order to influence the roll-over behavior of the vehicle. In particular, the fins, plates, or flippers 902, 904a, 904b could be constructed such that the outer points lie close to or on a virtual cylinder. In this way, the vehicle could rotate similar to a cylinder when it lies on its back or on one side. The vehicle could thus right itself again relatively quickly.

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- [FR1564711A \[0002\]](#)
- [FR2358174A1 \[0002\]](#)
- [US4219957A \[0002\]](#)
- [GB2427529A \[0004\]](#)
- [US6899589B1 \[0005\]](#)

Patentkrav

1. Køretøj (100), særligt legetøjsrobot med en øverste side, der udgør bagsiden af køretøjet, og i det mindste en side, omfattende:
5 en flerhed af ben (104) og et vibrationsdrev (202), der omfatter en motor og en excentrisk vægt, kendetegnet ved, at køretøjet (100) er konstrueret til at dreje i en retning, der er modsat af motorens omdrejningsretning, som følge af effekten af drejningsmomentet af vibrationsdrevet (202) og i den forbindelse rette sig selv op på flerheden af ben, hvis det ligger på sin bagende eller side.
- 15 2. Køretøj følge krav 1, kendetegnet ved, at den øverste side af køretøjet (100) rager frem for at gøre den selvoprettende proces af køretøjet (100) under vibrationen lettere.
- 20 3. Køretøj ifølge et af de foregående krav, kendetegnet ved, at der er tilvejebragt et højt punkt på den øverste side af køretøjet (100), så køretøjet (100) ikke kan ligge fuldstændigt vendt om på sin bagside.
- 25 4. Køretøj ifølge et af de foregående krav, kendetegnet ved, at der er anbragt en finne, plade eller ribbe (902) på dets bagdel.
5. Køretøj ifølge et af de foregående krav, kendetegnet ved, at der er anbragt finner, plader eller ribber (904a, 904b) på siderne af køretøjet (100).
30
6. Køretøj følge krav 4 eller 5, kendetegnet ved, at finnerne, pladerne eller ribberne (902, 904a, 904b) er konstrueret således, at deres yderpunkter ligger tæt på eller på en virtuel cylinder.
35
7. Køretøj ifølge et af de foregående krav, kendetegnet ved,

at der er tilvejebragt et rum, særligt en V-formet udsparring, mellem skroget af køretøjet (100) og benene (104) på køretøjet (100), således at benene (104) kan bøje indad under en oprettelse ved rotation.

5

8. Køretøj ifølge et af de foregående krav, kendetegnet ved, at benene (104) er anbragt på køretøjet (100), særligt på siden af rotationsaksen af vibrationsdrevet (202).

10 9. Køretøj ifølge et af de foregående krav, kendetegnet ved, at benene (104) er fastgjort på køretøjet (100) over tyngdepunktet.

15 10. Køretøj ifølge et af de foregående krav, kendetegnet ved, at benene (104) er fastgjort på siden og over rotationsaksen af vibrationsdrevet (202).

20 11. Køretøj ifølge et af de foregående krav, kendetegnet ved, at vibrationsdrevet (202) kan generere en kraft (F_v), der ledes nedad og er egnet til at bøje i det mindste forbenene, således at køretøjet (100) bevæges fremad.

25 12. Køretøj ifølge et af de foregående krav, kendetegnet ved, at bunden af benet er anbragt længere fremme på køretøjet (100) end den øverste del af benet, og ved at to eller flere ben (104), særligt forbenene, er indrettet til at blive bøjet, når køretøjet (100) vibrerer forårsaget af vibrationsdrevet (202).

30 13. Køretøj ifølge et af de foregående krav, kendetegnet ved, at vibrationsdrevet (202) kan generere en kraft (F_v), der ledes opad og er egnet til at få køretøjet (100) til at hoppe eller til at løfte forbenene op fra jordoverfladen.

35 14. Køretøj ifølge et af de foregående krav, kendetegnet ved, at den excentriske vægt er anbragt foran motoren, og ved at motorens rotationsakse strækker sig langs køretøjets (100) længdeakse.

15. Køretøj ifølge et af de foregående krav, kendetegnet ved,
at der er anbragt et batteri på bagdelen af køretøjet (100),
og at både batteriet og motoren er anbragt mellem benene
5 (104).

DRAWINGS

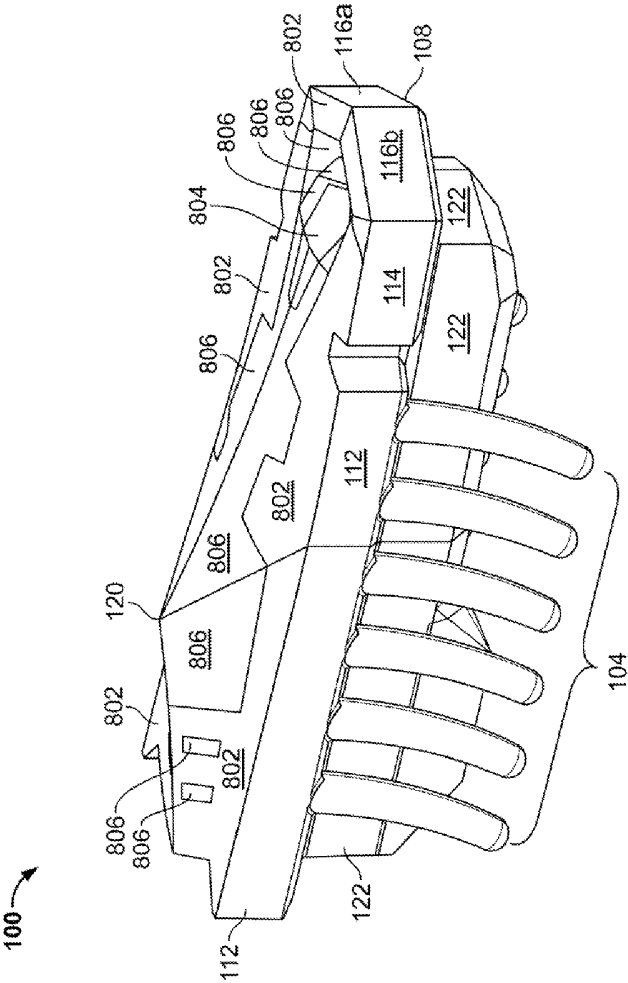
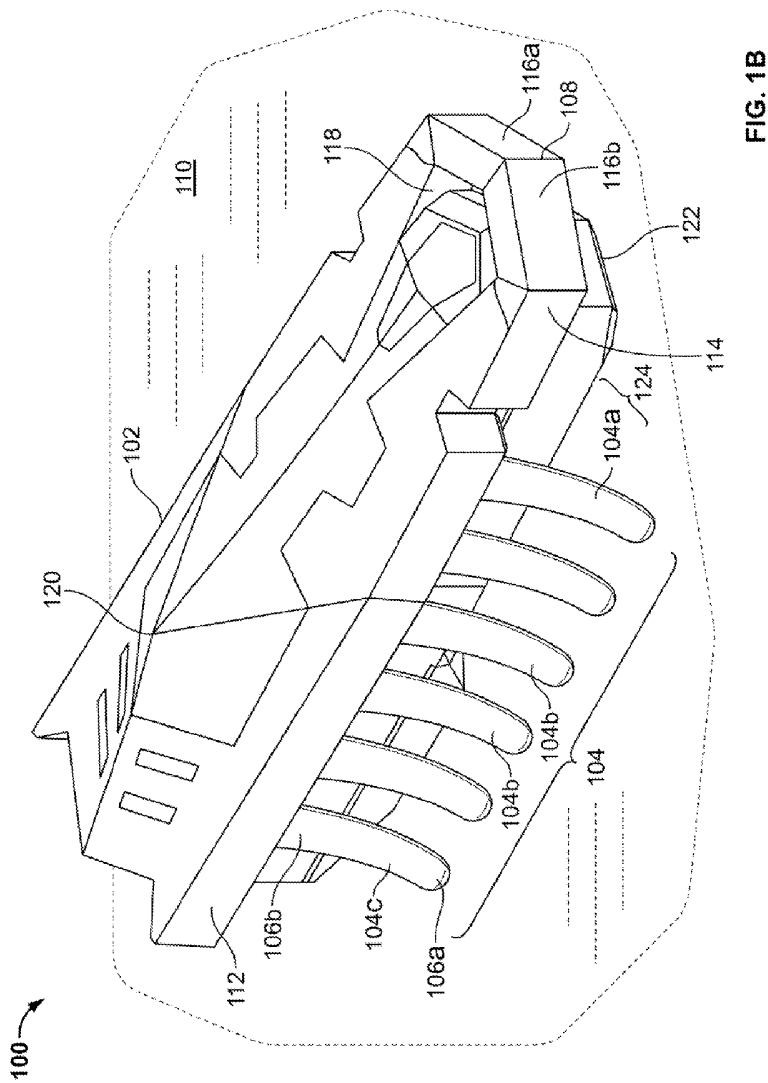


FIG. 1A



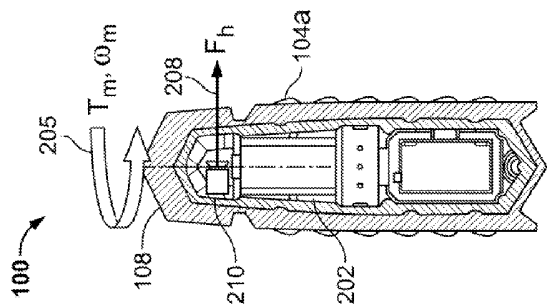


FIG. 2B

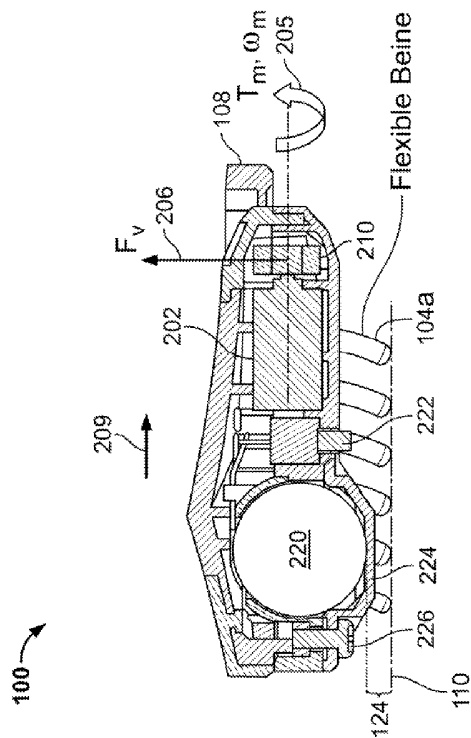


FIG. 2A

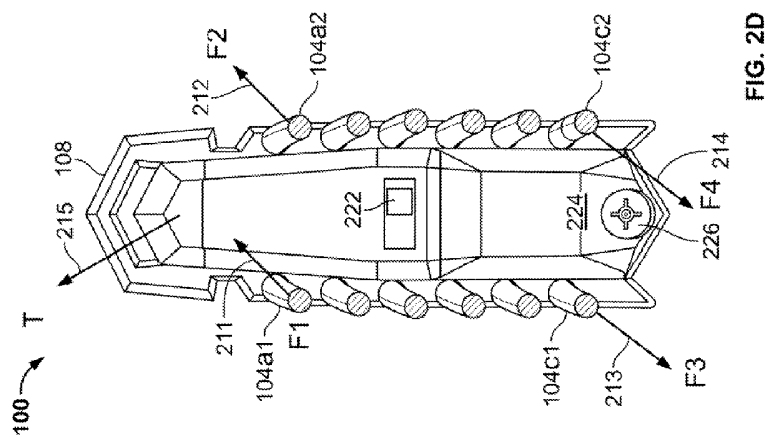


FIG. 2D

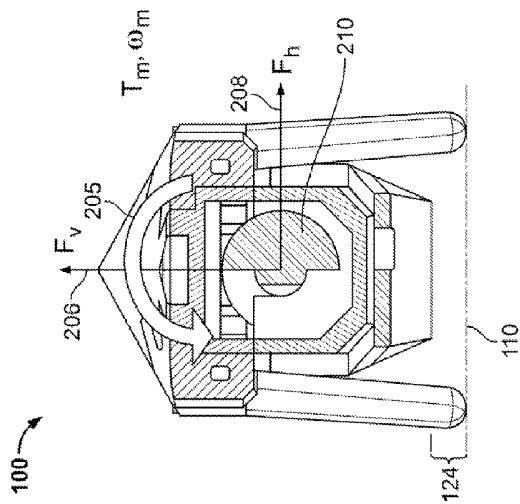


FIG. 2C

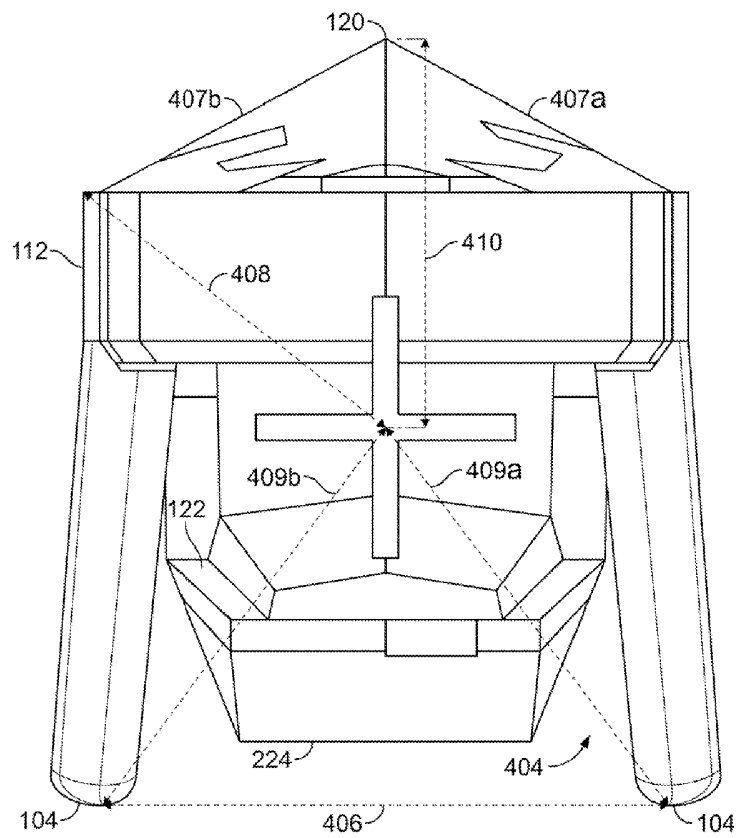


FIG. 2E

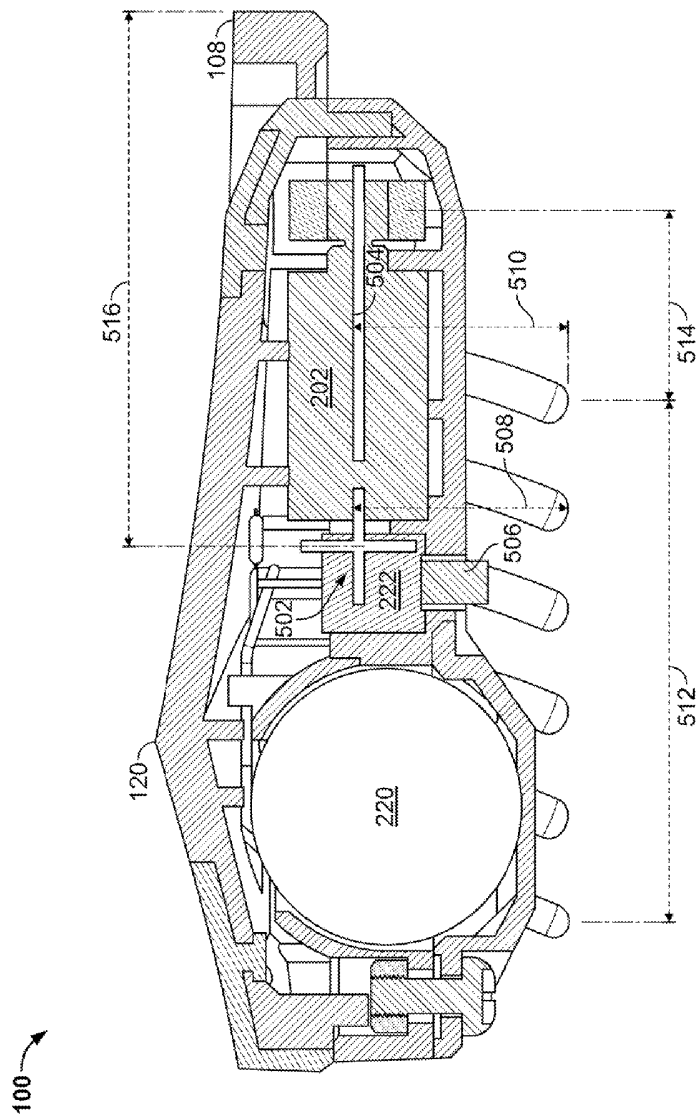


FIG. 2F

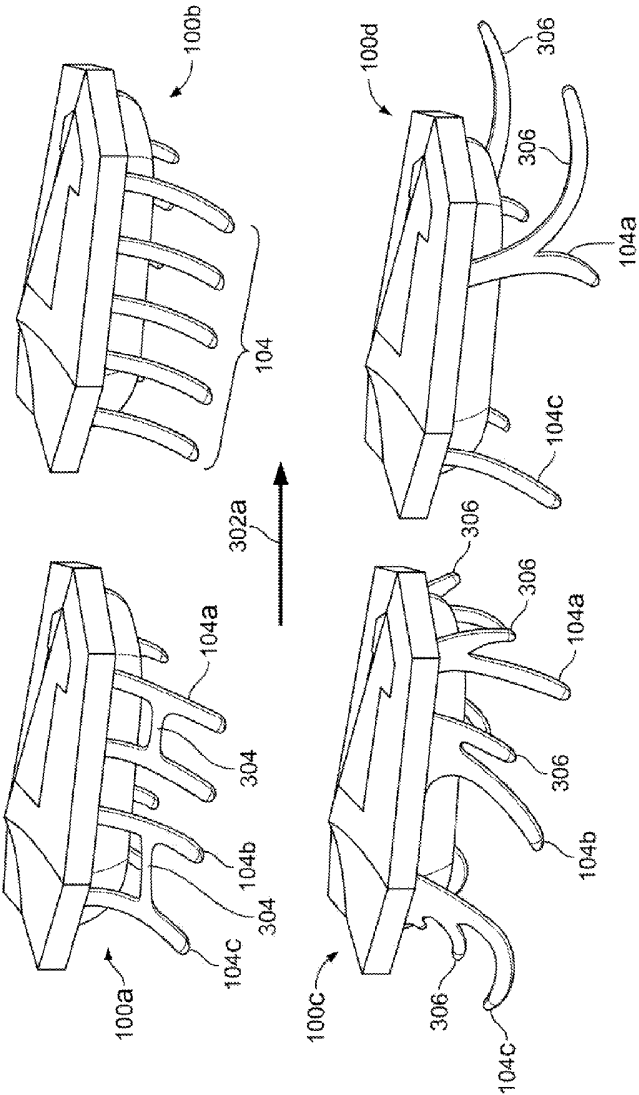
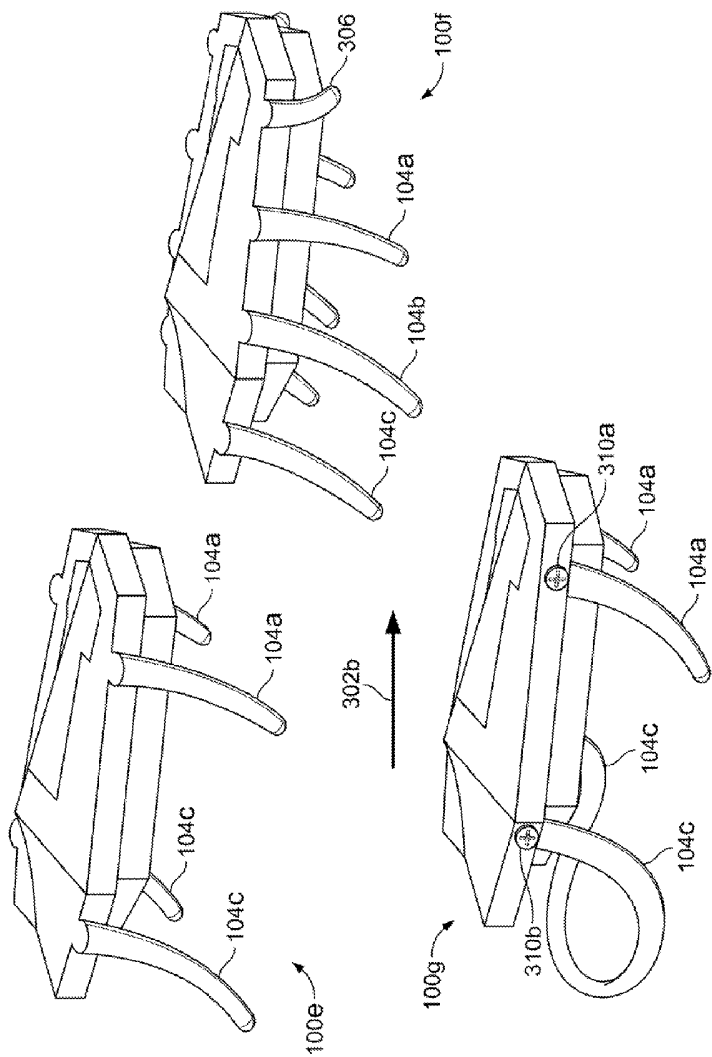
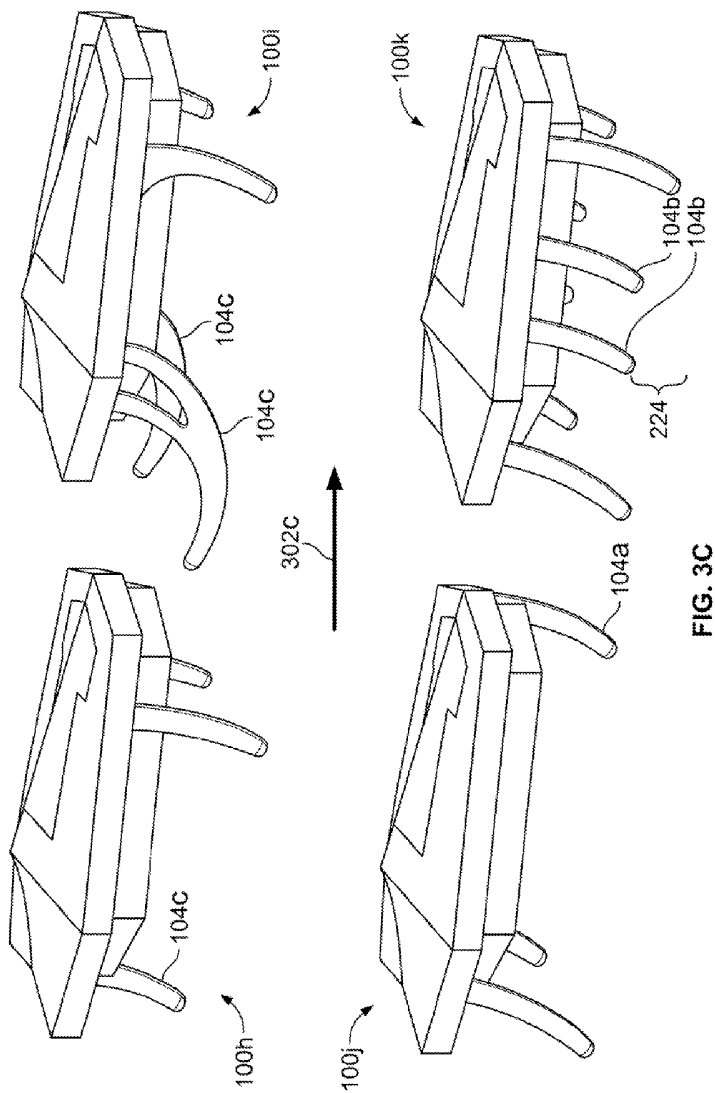


FIG. 3A





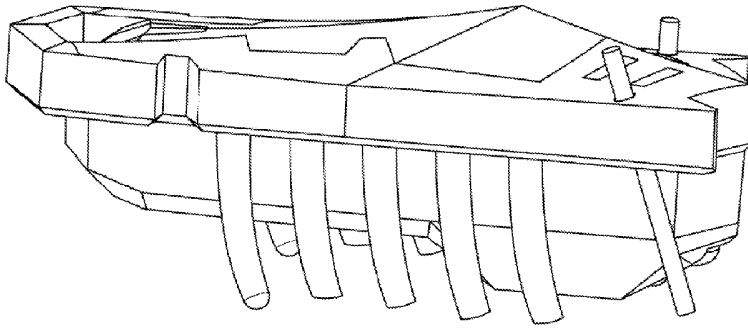


FIG. 4A

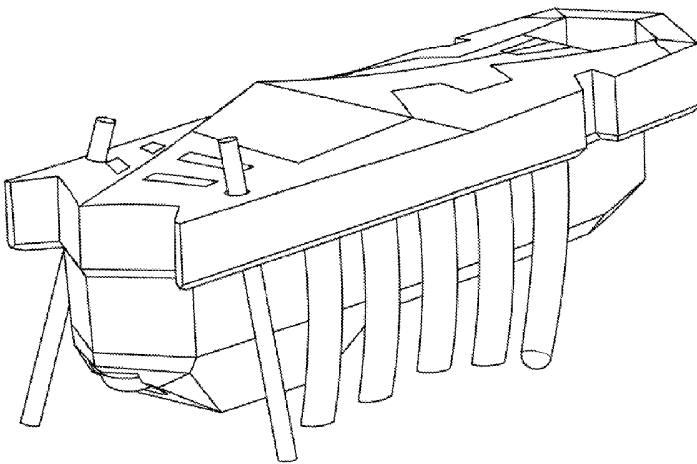


FIG. 4B

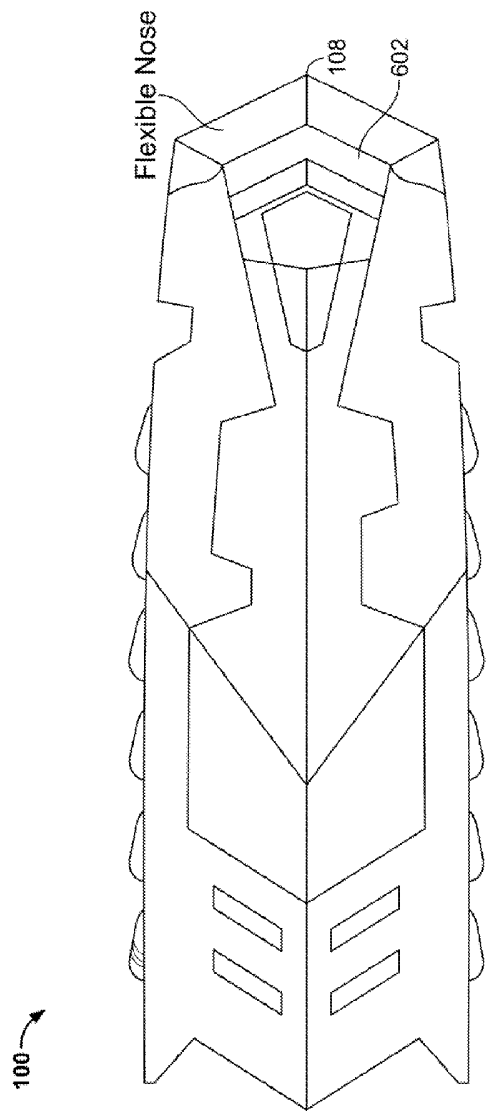


FIG. 5

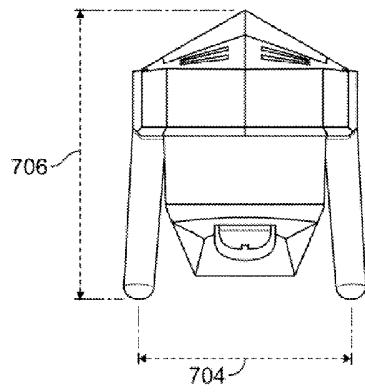


FIG. 6A

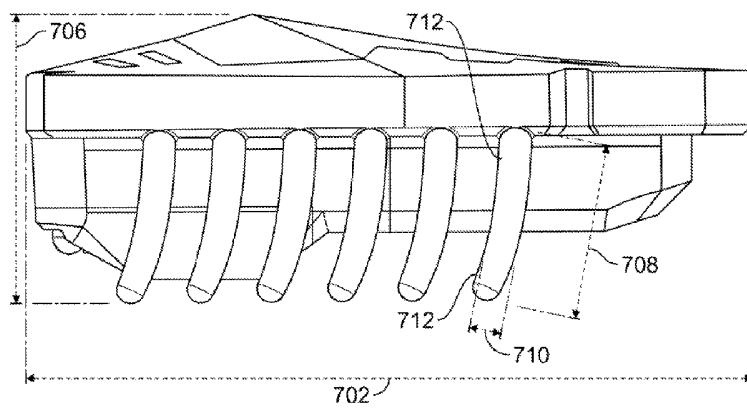


FIG. 6B

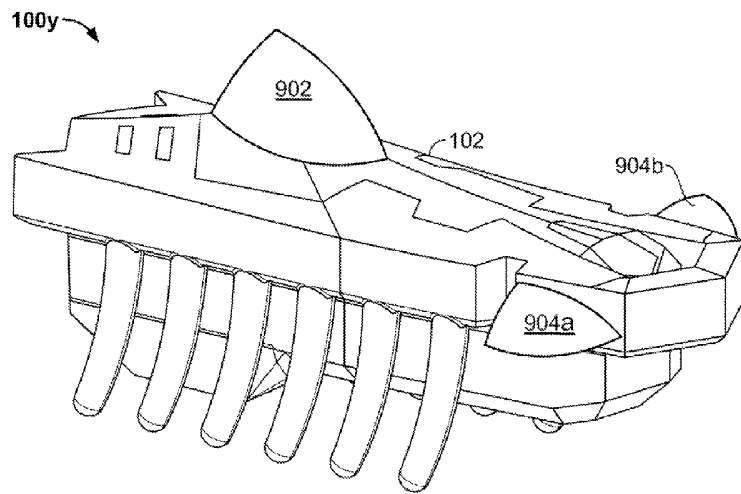


FIG. 7