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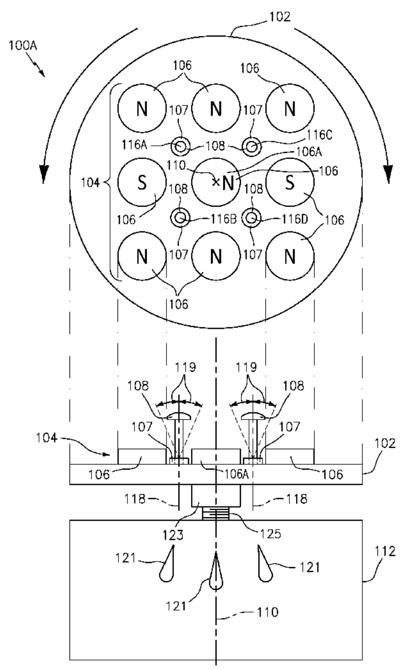


*FIG. 1*

**(57) Abstract:** A system and method for perturbing a permanent magnet asymmetric field to move a body includes a rotating body configured to rotate about a rotation axis, a permanent magnet arrangement arranged on the rotating body containing two or more permanent magnets, and a perturbation element. The permanent magnet arrangement is configured such that an asymmetric magnetic field is generated by the permanent magnets about a perturbation point. Actuation of the perturbation element at or near the perturbation point causes a tangential magnetic force on the rotating body and/or the permanent magnet arrangement, thereby causing the rotating body to rotate about the rotation axis. The disclosure may also be used for linear motion of a body.

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# SYSTEM AND METHOD FOR PERTURBING A PERMANENT MAGNET ASYMMETRIC FIELD TO MOVE A BODY

## CROSS-REFERENCE TO RELATED APPLICATION

**[0001]** This application claims the benefit of U.S. Provisional Patent Application No. 62/917,940 filed on January 9, 2019, which is hereby incorporated by reference in its entirety, to the fullest extent permitted under applicable law.

## BACKGROUND

**[0002]** Systems and methods for causing mechanical motion of a body, including rotational mechanical motion are known. Conventional systems and methods are known for generating mechanical energy or work or motion, such as electric motors. However, such systems use significant electrical power to run and are often inefficient. Thus, it would be desireable to design a system and method which overcomes the shortcomings of the prior art discussed above and provides work or motion very efficiency using less energy than conventional systems.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0003]** FIG. 1 is a top and side view of a permanent magnet asymmetric field system in accordance with embodiments of the present disclosure.

**[0004]** FIG. 2 is a top view of the permanent magnet asymmetric field system of FIG. 1 in accordance with embodiments of the present disclosure.

**[0005]** FIG. 3 is a top view of a permanent magnet asymmetric field system in accordance with embodiments of the present disclosure.

**[0006]** FIG. 4 is a top view of a permanent magnet asymmetric field system in accordance with embodiments of the present disclosure.

**[0007]** FIG. 5 is a side view of a permanent magnet asymmetric field system in accordance with embodiments of the present disclosure.

[0008] FIG. 6 is a top view of the permanent magnet asymmetric field system of FIG. 5 in accordance with embodiments of the present disclosure.

[0009] FIG. 7 is a side view of a permanent magnet asymmetric field system in accordance with embodiments of the present disclosure.

[0010] FIG. 8 is a side view of a permanent magnet asymmetric field system in accordance with embodiments of the present disclosure.

[0011] FIG. 9 is a top view of the permanent magnet asymmetric field system of FIG. 8 in accordance with embodiments of the present disclosure.

[0012] FIG. 10 is a perspective view of a permanent magnet asymmetric field system in accordance with embodiments of the present disclosure.

[0013] FIG. 11 is a top view of the permanent magnet asymmetric field system of FIG. 10 in accordance with embodiments of the present disclosure.

[0014] FIG. 12 is a side view of a permanent magnet asymmetric field system in accordance with embodiments of the present disclosure.

[0015] FIG. 13 is a top view of a permanent magnet asymmetric field system in accordance with embodiments of the present disclosure.

**DETAILED DESCRIPTION**

[0016] As discussed in more detail below, in some embodiments, the present disclosure is directed to systems and methods for perturbing a permanent magnet asymmetric field to provide motion of a body. The systems and methods of the present disclosure may use permanent magnets of any shape and size, based on the desired design parameters and may be configured with or without a housing. The present disclosure has a permanent magnetic arrangement resulting in an asymmetric magnetic field having potential energy stored in the magnetic field based on the magnetic (or flux) circuit configuration.

[0017] We have found that a small applied input force by a perturbation element that perturbes the asymmetric field causes a release of potentional energy by the permanent magnet configuration that results in an output force greater than the applied input force (or force amplification), thereby providing a permanent magnet driven (or assisted) force amplifier.

**[0018]** Referring to FIGS. 1 and 2, an exemplary embodiment of a permanent magnet asymmetric field system 100A is shown in accordance with embodiments of the present disclosure. The system 100A includes a rotating body (such as a flywheel) 102, a permanent magnet arrangement 104 having a plurality of permanent magnets 106, and a perturbation element (or a control rod or driver pin) 108. The rotating body 102 is configured to rotate about a rotation axis 110. The rotating body 102 is shown as being a connected to an alternator/generator 112, by a shaft 125, which may be attached to the body 102 by a bolt 123 or the like. Also, the alternator/generator 112 may have vent holes 12 to avoid overheating.

**[0019]** In this embodiment, the perturbation element 108 is a steel screw or nail or rod or pin constituting a ferrous body made of a ferrous material. This embodiment is shown with optional rests (or seats) 107 in the form of sockets for the tips of the perturbation elements 108. The rests 107 may be formed of plastic and/or metal, or any other material, or, in some embodiments may be divots or indentations in the bottom plate 102.

**[0020]** The permanent magnets 106 of the arrangement 104 are fixedly arranged on (or attached to) the rotating body 102 such that an asymmetric magnetic field is generated, with a resultant major magnetic field 114 (or major field 114) and minor magnetic field 115 (or minor field 115), about one or more perturbation points 116A, 116B, 116C, 116D (collectively “116”). Each perturbation point 116 has a cluster of four magnets 106 circumferentially surrounding the perturbation point 116, with each magnet 106 having an equal radial distance from the perturbation point 116 or substantially equal distance. Some clusters share one or more common magnets 106. In each cluster of magnets 106, there are three magnets 106 with an upper surface having the same north (N) polarity facing away from the rotating body 102 generating a major field and one magnet 106 with an upper surface having a south (S) polarity facing away from the rotating body 102 generating a minor field 115. Each perturbation point 116 has a perturbation axis 118 that is substantially parallel to the rotation axis 110. Also, there is a common magnet 106A located in the center of the configuration, about which the body 102 rotates.

**[0021]** If the body 102 (or bottom plate) is steel the magnets 1067 may be magnetically fixed or attached to the body 102; otherwise, the magnets 106 may be fixed to the body by bolts, glue, claimps, or other attachment means. They may also be embedded into the body if desired.

**[0022]** For the purposes of the present application, an asymmetric magnetic field comprising a “major” field and a “minor” field, with the major field 114 being larger in size than the minor field 115 and/or the major field 114 having a magnetic field strength greater than the minor field 115. In this embodiment, the magnets form a co-planar matrix pattern to form an H-pattern magnetic flux line of the major field 114. While this embodiment shows there being a greater number of magnets 106 for generating the major field 114 than the number of magnets 106 for generating the minor field 115, it is within the scope of the present disclosure for there to be a great number of magnets 106 for generating the minor field 115. For example, the magnets 106 generating the major 114 field may be less in number but “stronger” than the greater number of “weaker” magnets 106 generating the minor field. The magnets 106 for either field 114, 115 do not need to be of the same shape, size or strength, and there may be different magnet types/shapes for one or both fields 114, 115.

**[0023]** In this embodiment, the flywheel rotating body 102 is about 15” diameter x 1.25” thick and is about eighty (80) pounds and is a automotive/truck flywheel. However, other size, shape and weight rotating bodies 102 are within the scope of the present disclosure. The alternator/generator 112 is a fourty-eight (48) volt permanent magnet generator, model FREEDOM PMG made byMissouri Wind and Solar that reachces battery voltage at 266 rpm. However, other types of alternators/generators are within the scope of the present disclosure.

**[0024]** Various housing and magnet configurations are within the scope of the present disclosure. For example, and without limitation, the housing enclosing the permanent magnets 106 may be an enclosed high ferrous steel cylinder having an 8” outer diameter x 7” inner diameter x 2” height capped with an 8” diameter x 1/4" thick ferrous steel disc on the bottom and a 8” diameter x 1/4" thick aluminum cap on the top. As described herein, the cap, bottom, and sides) may be made of a ferrous material or non-ferrous material. The permanent magnets 106 may be, for example and without limitation, 1-1.25” diameter x 0.5" thick (or high) NdFe/cylindrical rare earth magnets, magnetized axially. The permanent magnets 106 can be purchased “off-the-shelf” from K&J Magnetics, Part Number DX48.

[0025] In operation, when the perturbation element 108 is arranged at a perturbation point 116 (or near a perturbation point 116) in an initial position such that a longitudinal extension of the perturbation element 108 is parallel to the perturbation axis 118 (or perpendicular to a surface of the rotating body 102 at the perturbation point 116) and then actuated to deviate from the perturbation axis 118 through a provided input force (or applied force) in a direction 120A, 120B, 120C, 120D towards a central point of the minor field 115 and/or a central point of the magnet(s) 106 generating the minor field 115. A deviation 119 from the perturbation axis 118 is shown in FIG. 1. The perturbation element 108 may be inserted at a substantially central part of the perturbation point 116, but systems and methods may work when the perturbation element 108 is radially offset from the central part of the perturbation point 116. In this embodiment, the central point of the minor field 115 is in alignment with the central point of the magnet 106 having a south polarity (S) facing away from the rotating body 102 (or bottom plate). The actuation of the perturbation element 108 to deviate away from the perturbation axis 118 in this manner causes a distortion (or perturbation) of the asymmetric field 114, 115 and generates a resulting tangential magnetic force on the permanent magnet arrangement 104 and/or the rotating body 102 about the rotation axis 110, thereby causing the rotating body 102 to rotate about the rotation axis 110 in either a counter-clockwise direction 122 or clockwise direction 124 assuming the tangential magnetic force is greater than the friction and/or load resisting the tangential magnetic force. Advantageously, the permanent magnet arrangement 104 allows for counter-clockwise direction 122 rotation and clockwise direction 124 rotation, which may be considered a forward and reverse option of bi-directionality.

[0026] In some embodiments, rotation of the rotating body 102 may be caused by actuation of the perturbation element 108 to deviate from the perturbation axis 118 in any direction. For example, a wobble of a few degrees of the perturbation element 108 from the perturbation axis 118 will also cause rotation of the rotating body 102.

[0027] In embodiments according to the present disclosure, the input force required to actuate the perturbation element 108 to deviate from the perturbation axis 118 is less than the resulting tangential magnetic force acting on the rotating body 102. This is possible due to the potential energy contained in the permanent magnet arrangement 104 that generates a tangential magnetic force to drive the rotating body 102 to rotate about the rotation axis 110 that is larger than the input force (or applied force) provided. Thus, the present disclosure provides a permanent magnetic-driven force amplifier.

**[0028]** The rotation of the rotating body 102 may be used for any application fit for a rotating body to perform work, such as, for example, generating electricity, propelling an automobile, driving a propeller of a boat or airplane, and the like. For example, embodiments according to the present disclosure may facilitate rotation in wind turbines, significantly reducing the input energy required at startup to generate electricity, particularly at low wind speeds. Embodiments may facilitate rotation in horizontal wind turbines (or HAWT) or vertical wind turbines (or VAWT). Embodiments according to the present disclosure may be coupled with a flywheel and an alternator or generator of a wind turbine. Embodiments according to the present disclosure may be used in residential, commercial, and/or utility scale use applications.

**[0029]** The rotating body 102 may be caused to rotate as described by the perturbation of the asymmetric field by the single perturbation element 108. However, any number of perturbation elements 108 may be actuated at their respective perturbation points 116. For instance, a first perturbation element 108 may be actuated at the perturbation point 116A while a second perturbation element 108 is simultaneously (or substantially simultaneously) actuated at the perturbation point 116D to drive the rotating body 102 in a counter-clockwise direction. Similarly, a third perturbation element 108 may be actuated at the perturbation point 116B while a fourth perturbation element 108 is simultaneously (or substantially simultaneously) actuated at the perturbation point 116C to drive the rotating body 102 in a clockwise direction. While the additional perturbation elements 108 are shown as being actuated at opposing perturbation points 116, in other embodiments the additional perturbation elements 108 are not at opposing perturbation points 116 about the rotation axis. For example, the perturbation elements 108 may be at perturbation points 116 at 30°, 45° or 90° angular separation. However, any other degree of angular separation is within the scope of the present disclosure. Depending on the number of magnets 106 and shape/configuration of the permanent magnet arrangement, there may be any number of perturbation elements 108 and/or perturbation points 116. The additional perturbation elements 108 and perturbation points 116 provide the ability to provide additional tangential magnetic force to the rotating body 102 depending on the strength of the magnets 106.

[0030] The magnets 106 shown and described in the embodiment of FIGS. 1 and 2 are cylindrical magnets. However, any type or shape of magnet is within the scope of the present disclosure. For example, the magnets 106 may be rectangular bar magnets, circular flat (or disc) magnets, or the like.

[0031] While the perturbation elements 108 has been shown and described as being a steel screw, it is within the scope of the present disclosure for the perturbation element 108 to be virtually any size and shape, and be made of any ferrous material, such as, for example, steel, steel alloys, iron, iron alloys, and the like. The perturbation element 108 may also be a permanent magnet, such as, for example, a conical magnet, a cylindrical magnet, or the like. A perturbation element 108 in the form of a magnet may provide for greater amplification of the input force (or applied force) by providing greater distortion or perturbation of the asymmetric magnetic field than a similar mass, size and/or shape ferrous body perturbation element 108. The mass, size and shape of the perturbation element 108 may be adjusted as desired to achieve the desired magnetic field perturbation properties of the perturbation element 108, for example, strength or tuning the amount of tangential magnetic force per degree or distance of actuation 119 of the perturbation element 108. In some embodiments, greater amplification of the input force may be achieved by arranging a bias magnet to the ferrous control rod with the same polarity as the polarity of the side of the magnets 106 facing away from the rotating body 102 that generate the minor field 115 is arranged on the upper, or distal end, of the perturbation element 108.

[0032] Referring to FIG. 3, a permanent magnet asymmetric field system 100B is shown that is substantially the same as the permanent magnet asymmetric field system 100A of FIGS. 1 and 2 except that two of the magnets 106 are removed. In this embodiment, the system 100B only has two clusters of four magnets 106 surrounding two perturbation points 116B, 116C with a common central magnet 106A. The system 100B operates in the same manner under the same principles as shown and described above in connection with the system 100A FIGS. 1 and 2. One difference between the system 100B shown in FIG. 3 and the system 100A of FIGS. 1 and 2, is that the permanent magnet arrangement 104 of the system 100B only generates an asymmetric field 114, 115 about two perturbation points 116B, 116C that can be perturbed to generate tangential magnetic forces 120B, 120D, which result in rotation in the same direction, the clockwise direction 124.

**[0033]** Referring to FIG. 4, a permanent magnet asymmetric field system 100C is shown that is substantially the same as the permanent magnet asymmetric field system 100A of FIGS. 1 and 2 except that five of the magnets 106 are removed. In this embodiment, the system 100C only has one cluster of four magnets 106 surrounding one perturbation point 116C and the body rotates about the center of the magnet 106A. The system 100C operates in the same manner under the same principles as shown and described above in connection with the system 100A FIGS. 1 and 2. One difference between the system 100C shown in FIG. 4 and the system 100A of FIGS. 1 and 2, is that the permanent magnet arrangement 104 of the system 100C only generates an asymmetric field 114 about one perturbation point 116C that can be perturbed to generate a tangential magnetic force 120D, which results in rotation in one direction, the clockwise direction 124.

**[0034]** Referring to FIGS. 5 and 6, a permanent magnet asymmetric field system 100D is shown that is substantially the same as the permanent magnet asymmetric field system 100A of FIGS. 1 and 2. The system 100D includes an actuation input device 200. In this embodiment, the actuation input device 200 is an electric motor having an output shaft configured to rotate two actuation arms 202A, 202B (collectively "202") about an actuation rotation axis 204 that is substantially parallel to or the same as the rotation axis 110. The actuation input device 200 is in operative communication with a controller 206 configured to control the actuation force provided by the actuation arms 202 and the timing of their actuation. The electric motor 200 is a twelve (12) volt DC high-rpm, low-torque direct current motor, model XD-3420, DC 12 volt, 3,000 RPM, similar to that used in radio controlled cars and toys and small industrial actuator applications.

**[0035]** Referring to FIG. 7, a permanent magnet asymmetric field system 100E is shown that is substantially the same as the permanent magnet asymmetric field system 100D of FIGS. 5 and 6. The system 100E includes a force assist device 208 that applies force (or pressure) against the actuation arms 202. The force assist device 208 distributes the weight of a threaded weighted-element 210 (*e.g.* 2.2 lbs) through a threaded drive screw mechanism 212 such as a spiral gear or helical gear with high helix angle cause against the arms 202 to apply a force against the pins

108. The assistance of the force assist device 208 maintains against the pins 108 by against the arms 202 to assist the motor and to reduce the impact of vibrations or disturbances from causing a separation of the arms 202 from the perturbation elements 108 that would otherwise cause non-uniform rotation of the rotating body 102. While the force assist device 208 in this embodiment is a “gravity” type force assist device, other force assist devices that utilize active force assist are within the scope of the present disclosure. In that case, the motor shaft 216 and screw drive shaft 212 both drive the arms 202A to put force on the perturbation pins 108.

**[0036]** Referring to FIGS. 8 and 9, a permanent magnet asymmetric field system 100F is shown in accordance with embodiments of the present disclosure. The system 100F includes two permanent magnet arrangements 104A, 104B arranged on the rotating body 102, each of the arrangements 104A, 104B having four permanent magnets 106 around a perturbation point 116E, 116F, and having the perturbation element 108 extending from the same, similar to the system 100B of FIG. 3 except that the arrangements 104A, 104B do not share any common permanent magnets in the clusters (or permanent magnetic arrangements) surrounding the perturbation points 116E, 116F. The arrangements 104A, 104B are arranged radially offset from the rotation axis 110. It is within the scope of the present disclosure to configure the permanent magnet arrangement(s) 104 to locate the perturbation point(s) 116 at a desired radial distance (d), e.g. 8 inches, from the rotation axis 110. The perturbation and operation of the arrangements 104A, 104B are substantially as discussed above in connection with other embodiments. One or both of the perturbation points 116E, 116F may have the perturbation element 108 actuated therein in order to perturb the asymmetric magnetic field(s). The resulting tangential magnetic forces 320A, 320B from the perturbation(s) on the arrangements 104A, 104B will cause the rotating body 102 to rotate about the rotation axis 110. Each arrangement 104A, 104B is arranged in an optional housing 300A, 300B.

**[0037]** Each arrangement 104A, 104B is enclosed in a 5” outer diameter x 4” inner diameter x 1.5” height enclosed ferrous steel cylinder housing 300A, 300B capped on top with a 5” diameter 1/4" thick aluminum disc and a bottom plate of same dimensions made of steel. However, as discussed herein, other housing 300A, 300B configuration shapes and sizes are within the scope of the present disclosure. Also, as discussed above, the housings 300A, 300B are optional and the permanenet magnets 106 may be arranged or fixed diretly on the rotating body 102. In this embodiment, the rotating body 102 is the 80 lb flywheel discussed hereinbefore. However, other rotating body 102 size, shape and materials are within the scope of the present disclosure. The rotating body 102 may be made of ferrous or non-ferrous materials.

**[0038]** Also, the motor drive and/or spiral gear arrangement with rotating arms to press against the perturbation pins 108 shown in figs 5-7 may be used with this embodiments of Figs 8 and 9.

**[0039]** Referring to FIGS. 10 and 11, a permanent magnet asymmetric field system 100G is shown in accordance with embodiments of the present disclosure. The system 100G includes a cylindrically-shaped rotating body 402, a plurality of wall magnets 406, two cylindrical bias magnets 407A, 407B (collectively "407") and a perturbation element 408. The rotating body 402 is configured to rotate about a rotation axis 410. The wall magnets 406 are arranged on an inner circumferential wall 412 of the rotating body 402. The wall magnets 406 on one side of an imaginary equator 414 that bifurcates the rotating body 402 have a side facing the rotation axis 410 with a north polarity (N) and the wall magnets 406 on the opposite side of the imaginary equator 414 have a side facing the rotation axis 410 with south polarity (S). The bias magnets 407 are arranged at the perturbation points 416 on a bottom surface 418 of the rotating body 402, are aligned on an "equator" 414 and are radially offset from the rotation axis 410. The upper surfaces of the bias magnets 407 facing away from the bottom surface 418 have different polarities. In particular, the upper surface of the bias magnet 407A has north polarity (N) and the upper surface of the bias magnet 407B has south polarity (S).

**[0040]** In some embodiments, the wall magnets 406 are rectangular permanent magnets that are 3" long, 1/2" wide and 1/4" thick; the bias magnets are cylindrical magnets that are 1/4" diameter and 1/8" thick; the housing has an outer diameter of 4", an inner diameter of 3.5" and a height of 4". The housing has an open top, but fully enclosed cylinders or cylindrically-shaped housings are within the scope of the present disclosure as are other shapes such as rectangles, ovals, triangles, etc. In some embodiments, the housing is made of a ferrous material and in other embodiments the housing is made of a non-ferrous material. In some embodiments, the housing has some ferrous material and some non-ferrous material, e.g., a cylindrically-shaped housing with a wall 412 and bottom surface 418 made of a ferrous material (e.g., steel) and a top made of a non-ferrous material (e.g., plastic or aluminum). However, other dimensions, shapes and material choices are within the scope of the present disclosure and may be changed as the application requires or is desired.

**[0041]** The wall magnets 406 and bias magnets 407 generate a magnetic flux field line 420A that deviates from the equator 414 near the bias magnets 407, but intersects the equator 414 substantially near the point where the rotation axis 410 intersects the equator 414. Specifically, the magnetic flux field line 420A deviates from the equator 414 towards the wall magnets 406 having a side facing the rotation axis 410 that is of opposite polarity to the upper surface of the bias magnets 407. The configuration of the magnetic flux field line 420A causes two perturbation points 416 located substantially at the location of the bias magnets 407. The bias magnets 407 may be located about on third of the distance from the inner walls to the center of rotation 410.

**[0042]** In operation, the perturbation element 408 is inserted into the rotating body 402 at (or substantially at) either of the perturbation points 416 such that a longitudinal extension of the perturbation element 408 is parallel or substantially parallel to the rotation axis 410. The perturbation element 408 is then actuated to move or tilt toward the magnetic flux field line 420A in the direction 430A. The actuation of the perturbation element perturbs the asymmetric magnetic flux field line 420A and generates a resulting tangential magnetic force on the wall magnets 406, bias magnets 407 and/or the rotating body 402 about the rotation axis 410, thereby causing the rotating body 402 to rotate about the rotation axis 410 in a counter-clockwise direction 422 assuming the tangential magnetic force is greater than the friction and/or load resisting the tangential magnetic force. As discussed above in connection with other embodiments, there may be an additional perturbation element 408 (not shown) such that there is a perturbation element 408 actuated at both perturbation points 416 simultaneously, if desired, which may provide twice the rotational force on the body 402.

**[0043]** In some embodiments, the upper surface of the bias magnets 407 may have the same polarity (N-N; or S-S). In such embodiments, for a N-N arrangement, the magnetic flux field line would have the shape of the magnetic flux field line 420B on the right side of the axis 410. This configuration allows for bi-directional rotation of the body 402. For instance, a perturbation element 408 actuated at the perturbation point 416 at the bias magnet 407A, in the direction 430A, would cause counter-clockwise 422 rotation of the rotating body 402, while actuation of the perturbation element 408 (or actuation of a second perturbation element 408) at the perturbation point 416 at the bias magnet 407B, in the direction 432B, would cause clockwise 424 rotation of the rotating body 402.

**[0044]** One of the two bias magnets 407 is optional and may be removed. For example, if the bias magnet 407B is removed, then the magnetic flux field line 420A would only deviate from the equator substantially at the single bias magnet 407A. In this embodiment, there would only be one perturbation point 416 at the single bias magnet 407A.

**[0045]** Referring to FIG. 12, a permanent magnet asymmetric field system 100H is shown in accordance with embodiments of the present disclosure. The system 100H includes a rotating body 502, a permanent magnet arrangement 504 having a plurality of magnets 506 similar to the arrangements 300A, 300B in Figs. 8 and 9 and a perturbation element 508. The system 100H further includes a perturbation element guide (or support) 510 defining a perturbation element opening 512. The perturbation element opening 512 is configured to receive the perturbation element 508 and is located around a perturbation axis 514 that would cause motion of the rotating body 502 if the perturbation element 508 is actuated to deviate from the perturbation axis 518 or towards a magnetic flux field line as discussed herein in connection with other embodiments. The perturbation element guide 510 serves to limit the range of deviation of the perturbation element 508 from the perturbation axis 514 (or distance 119 (Fig. 1) from a magnetic flux field line). The guide 510 may advantageously prevent the perturbation element 508 from by an actuating device such as an electric motor and/or gravity weight such as in FIGS. 5-7, *i.e.*, being actuated by a distance greater than required or desired. The guide 510 may also advantageously constitute a stop to prevent the perturbation element 508 from being moved by the magnets 506 when the perturbation element 508 is not being actuated or held by an actuating device. The guide 510 may be a cover or cap with a hole 512 and may be used with any embodiment herein to limit the range of motion of the perturbation element 508.

**[0046]** The perturbation element opening 512 may be any size or shape as is desired or as the application requires. For example, the perturbation element opening 512 may be a circular hole, a straight slot, a curved slot or a zig-zag slot. However, other shapes are within the scope of the present application.

[0047] Referring to Figure 13, while the embodiments discussed above have been in connection with systems having a rotating body that rotates about a rotation axis. permanent magnet asymmetric field systems that generate non-rotation motion (e.g. translational or linear motion) are within the scope of the present disclosure. For example, referring to FIG. 13, a permanent magnet asymmetric field system 100I is shown in accordance with embodiments of the present disclosure. The system 100I includes a linear motion body 602 having a plurality of bearings (or wheels) 603, a permanent magnet arrangement 604 having a plurality of magnets 606, and a perturbation element 608. The permanent magnet arrangement 604 generates a major field and minor field as discussed above in connection with other embodiments. When the perturbation element 608 is deviated or moved towards the minor field in a direction 610, the resulting magnetic force on the magnets 606 and/or the linear motion body 602 causes the linear motion body 602 to move in the direction 612. The bearings 603 serve to reduce the friction or resistance the linear motion body 602 may encounter in being forced to move in the direction 612.

[0048] The linear motion body 602 is shown as being arranged in an optional linear track 614 which may have guard rails. The linear track 614 confines the linear motion body 602 to prevent the linear motion body 602 from moving in any non-linear directions from the track 614. The bi-directionality discussed above in connection with rotating embodiments is also applicable to linear motion embodiments. In particular, there may be a magnet arrangement where perturbation of the perturbation element 608 (or a different perturbation element) causes the linear motion body 602 to move in the opposite linear direction, thereby giving a forward and reverse control of the system 100I.

[0049] In embodiments according to the present disclosure, the magnets are arranged to work facilitating rotation in structures such as wind turbines, which may significantly reduce the input energy required to initiate rotation of the wind turbine.

[0050] Dimensions provided herein are approximate and other dimensions may be used if desired provided they provide the same function and performance described herein.

[0051] For the embodiments disclosed herein, the perturbation of the asymmetric field causes a release of potential energy from the permanent magnets into kinetic energy in the form of angular or linear (translational) velocity or acceleration. We have found that small input forces acting on the perturbation element positioned at or near parallel to the rotational axis (or perpendicular to the floor of the arrangement) causes an amplified output force due to such energy release (or conversion to kinetic energy).

**[0052]** While specific permanent magnet arrangements have been shown and described as generating the asymmetric magnetic field(s) about the perturbation point(s), it is within the scope of the present disclosure for the permanent magnet arrangement to be virtually any other shape or configuration, or number of magnets, as long as the arrangement is configured to generate an asymmetric magnetic field about the perturbation point(s). For instance, a permanent magnet arrangement that would otherwise generate a symmetric magnetic field about the perturbation point(s) but for the presence of magnetic field shielding, interfering or diverting structure(s) are within the scope of the present disclosure, *i.e.* the magnetic field shielding, interfering or diverting structure(s) ultimately causes the permanent magnet arrangement to generate an asymmetric field about the perturbation point(s).

**[0053]** The magnetic field lines shown and described herein are an approximation of the location of the magnetic fields. The actual shape and location of the magnetic fields or field lines may be different than as shown and/or may vary based on physical characteristics and materials of the system.

**[0054]** It should be readily understood that the magnetic polarity of the magnets of the systems and methods described herein can be reversed and achieve the same intended function and structure. Specifically, a magnet side (or surface) having north pole *N* polarity may instead have south pole *S* polarity and a magnet side (or surface) having south pole *S* polarity may instead have north pole *N* polarity, and the permanent magnet asymmetric systems and methods will function substantially the same as disclosed herein.

**[0055]** While the present disclosure has shown and described the permanent magnets as being circular flat magnets, cylindrical magnets and bar magnets, it should be readily understood that any permanent magnet shape is within the scope of the present disclosure. The magnet(s) may differ in shape and type. For example, the cylindrical magnets may be cylinders and/or cylinders with a central bore or hole defined therein in a longitudinal direction of the cylindrical magnet(s). Instead of the central bore (or in addition thereto), the magnets may be provided with blind bores. Magnets may be configured with the necessary central bore and/or blind bores for enhancing the magnetic fields thereof or generating the desired magnetic fields thereof. Other magnet shapes, such as rectangular magnets or flat magnets, may have transverse (through the thickness) bores or holes or blind bores for enhancement or desired magnetic field shapes/strengths. Further, while various magnets have been described as being separate magnets, it is within the scope of the present disclosure for the magnets to form a single, unitary piece or structure. Also, any given permanent magnet described herein may comprise a plurality of smaller permanent magnets that are stacked together to perform the same function and polarity as the given permanent magnet, if desired.

**[0056]** Although the invention has been described and illustrated with respect to exemplary embodiments thereof, the foregoing and various other additions and omissions may be made therein and thereto without departing from the spirit and scope of the present disclosure. It should be understood that, unless otherwise explicitly or implicitly indicated herein, any of the features, characteristics, alternatives or modifications regarding a particular embodiment herein may also be applied, used, or incorporated with any other embodiment described herein.

## CLAIMS

What is claimed is:

1. A permanent magnet asymmetric field system for moving a body, comprising:

a rotating body configured to rotate about a rotation axis;

a permanent magnet arrangement arranged on the rotating body containing two or more permanent magnets; and

a perturbation element;

wherein the permanent magnet arrangement is configured such that an asymmetric magnetic field is generated by the permanent magnets about a perturbation point; and

wherein actuation of the perturbation element at or near the perturbation point with an input force causes a tangential magnetic output force on the rotating body or the permanent magnet arrangement, thereby causing the rotating body to rotate about the rotation axis; and

wherein the actuation of the perturbation element causes a perturbation of the asymmetric field causing a release of potential energy from the permanent magnet arrangement to create the output force causing the rotation.

2. The permanent magnet asymmetric field system according to claim 1, wherein the perturbation element comprises a ferrous material.

3. The permanent magnet asymmetric field system according to claim 2, wherein the perturbation element comprises iron.

4. The permanent magnet asymmetric field system according to claim 1, wherein the perturbation element comprises a magnet.

5. The permanent magnet asymmetric field system according to claim 4, wherein the magnet is a conical magnet.

6. The permanent magnet asymmetric field system according to claim 1, wherein the permanent magnet arrangement contains four magnets arranged about the perturbation point, and wherein three magnets of the four magnets have a side facing away from the rotating body that share a first polarity and one magnet of the four magnets has a side facing away from the rotating body having a second polarity.

7. The permanent magnet asymmetric field system according to claim 1, further comprising an actuation input device configured to actuate the perturbation element.

8. The permanent magnet asymmetric field system according to claim 7, wherein the actuation input device is an electric motor.

9. The permanent magnet asymmetric field system according to claim 1, wherein the asymmetric magnetic field comprises a major field and a minor field, and wherein the major field is larger than the minor field and/or the major field has greater magnetic field strength than the minor field.

10. The permanent magnet asymmetric field system according to claim 9, wherein actuation of the perturbation element at or near the perturbation point causes the perturbation element to deviate from a perturbation axis, and wherein the perturbation axis is substantially parallel to the rotation axis.

11. A permanent magnet asymmetric field system for rotating a body, comprising:

a rotating body configured to rotate about a rotation axis;

a permanent magnet arrangement arranged on the rotating body containing two or more permanent magnets; and

a first perturbation element;

wherein the permanent magnet arrangement is configured such that an asymmetric magnetic field is generated by the permanent magnets about a plurality of perturbation points; and

wherein actuation of the first perturbation element at or near one of the perturbation points causes a first tangential magnetic force on the rotating body and/or the permanent magnet arrangement, thereby causing the rotating body to rotate about the rotation axis.

12. The permanent magnet asymmetric field system according to claim 11, further comprising a second perturbation element, wherein actuation of the second perturbation element at or near one of the perturbation points causes a second tangential magnetic force on the rotating body and/or the permanent magnet arrangement, thereby causing the rotating body to rotate about the rotation axis, and wherein the first tangential magnetic force and the second tangential magnetic force cause the rotating body to rotate in the same direction.

13. The permanent magnet asymmetric field system according to claim 11, wherein the plurality of perturbation points comprises at least four perturbation points, wherein actuation of the first perturbation element at a first pair of the at least four perturbation points causes the rotating body to rotate in a first direction, and wherein actuation of the first perturbation element at a second pair of the at least four perturbation points causes the rotating body to rotate in a second direction, and wherein the second direction is opposite to the first direction.

14. The permanent magnet asymmetric field system according to claim 11, wherein the asymmetric magnetic field comprises a major field and a minor field, and wherein the major field is larger than the minor field and/or the major field has greater magnetic field strength than the minor field.

15. The permanent magnet asymmetric field system according to claim 14, wherein actuation of the perturbation element at or near the perturbation point causes the perturbation

element to deviate from a perturbation axis, and wherein the perturbation axis is substantially parallel to the rotation axis.

16. A method of perturbing a permanent magnetic asymmetric field system to move a body, comprising:

providing a permanent magnetic asymmetric field system comprising:

a rotating body configured to rotate about a rotation axis;

a permanent magnet arrangement arranged on the rotating body containing two or more permanent magnets; and

a perturbation element;

wherein the permanent magnet arrangement is configured such that an asymmetric magnetic field is generated by the permanent magnets about a perturbation point;

actuating the perturbation element at or near the perturbation point to cause a tangential magnetic force on the rotating body and/or the permanent magnet arrangement, thereby causing the rotating body to rotate about the rotation axis.

17. The method according to claim 16, wherein the actuating of the perturbation element causes the perturbation element to deviate from a perturbation axis, and wherein the perturbation axis is substantially parallel to the rotation axis.

18. The method according to claim 16, wherein the actuating of the perturbation element actuates the perturbation element from an initial position where a longitudinal extension of the perturbation element is perpendicular to a surface of the rotating body at the perturbation point.

19. The method according to claim 16, wherein the actuating of the perturbation element is performed by an actuating arm driven by an electric motor.

20. The method according to claim 19, wherein the electric motor is configured to rotate the actuating arm about an actuation rotation axis, wherein the actuation rotation axis is substantially parallel to the rotation axis.

21. A permanent magnet asymmetric field system for moving a body, comprising:

a rotating body configured to rotate about a rotation axis;

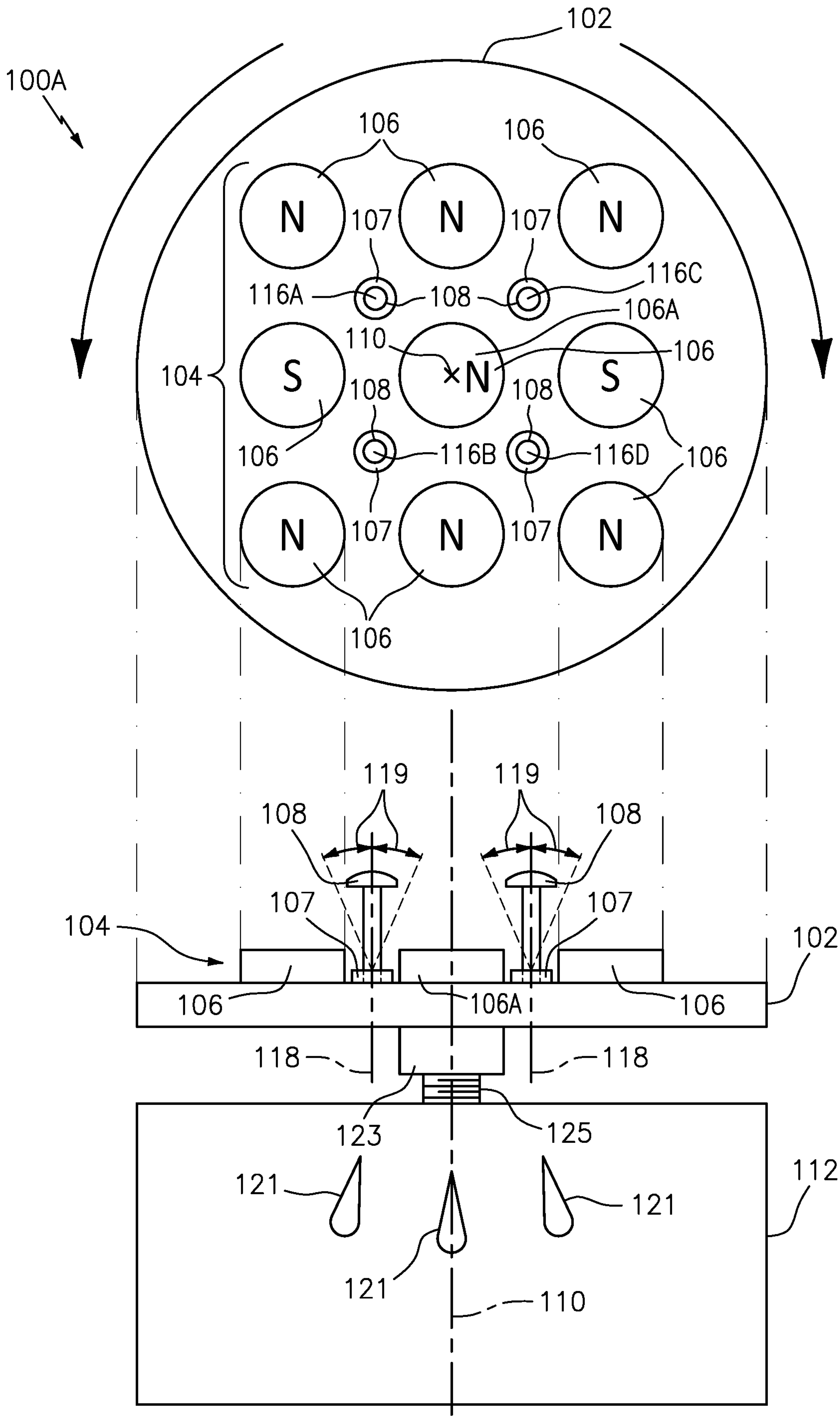
a permanent magnet arrangement arranged on the rotating body containing two or more permanent magnets; and

a perturbation element;

wherein the permanent magnet arrangement is configured such that an asymmetric magnetic field is generated by the permanent magnets about a perturbation point; and

wherein actuation of the perturbation element at or near the perturbation point with an input force causes a tangential magnetic output force on the rotating body or the permanent magnet arrangement, thereby causing the rotating body to rotate about the rotation axis; and

wherein the actuation of the perturbation element causes a perturbation of the asymmetric field causing a release of potential energy from the permanent magnet arrangement to create the output force causing the rotation, wherein the input force is less than the output force.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116B
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FIG. 1

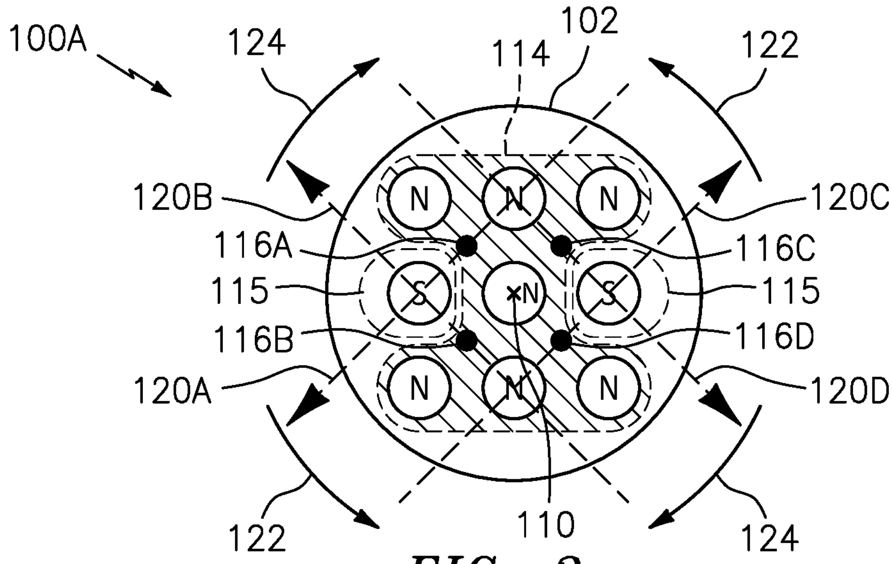


FIG. 2

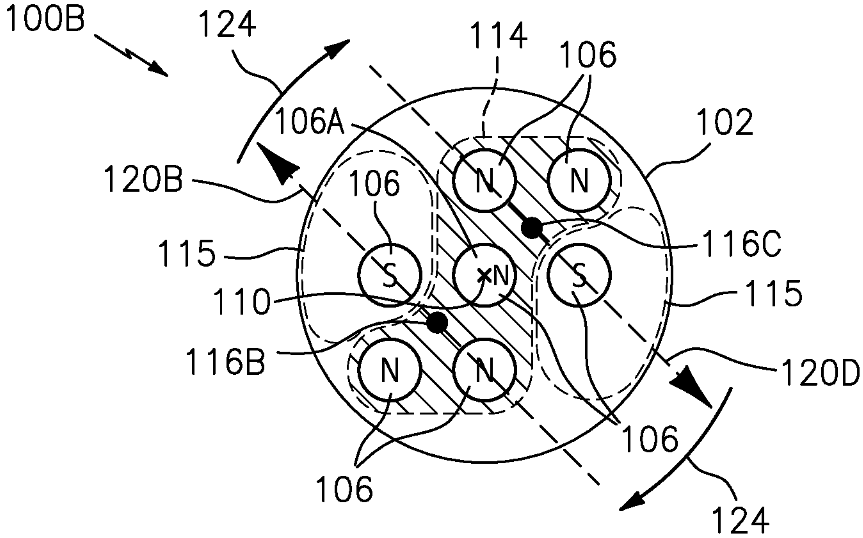


FIG. 3

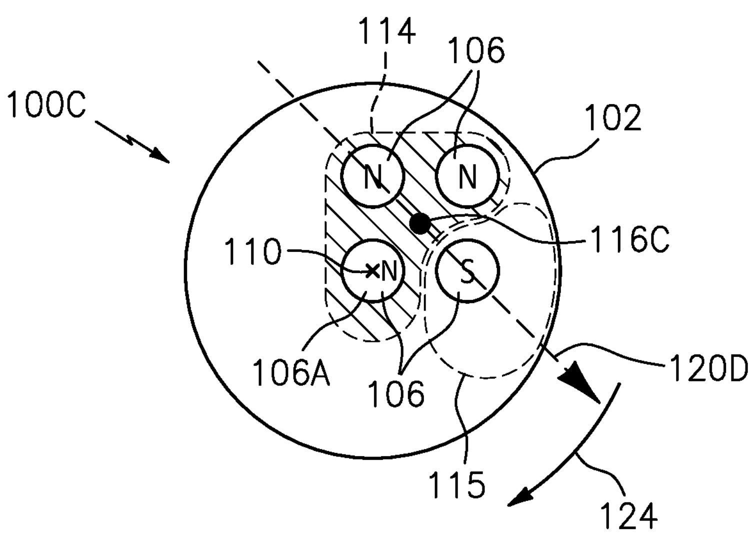


FIG. 4

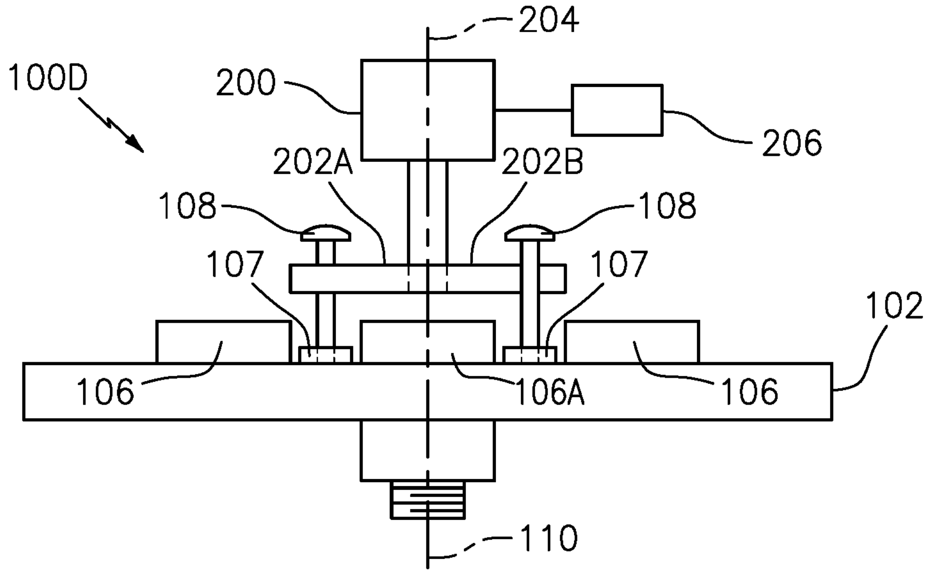
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*FIG. 5*

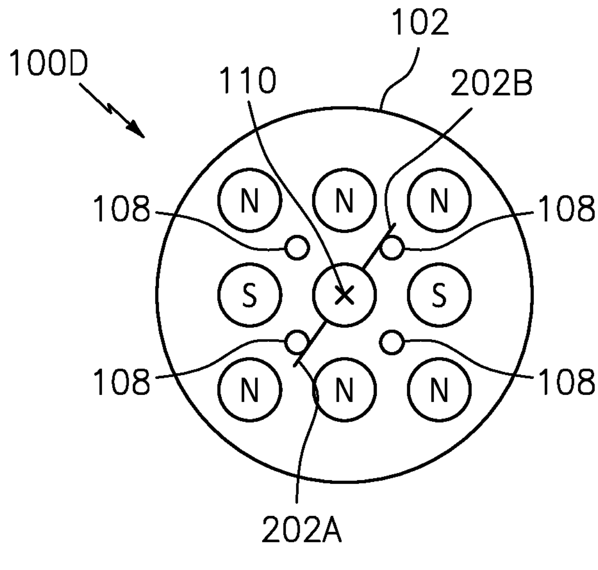
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*FIG. 6*

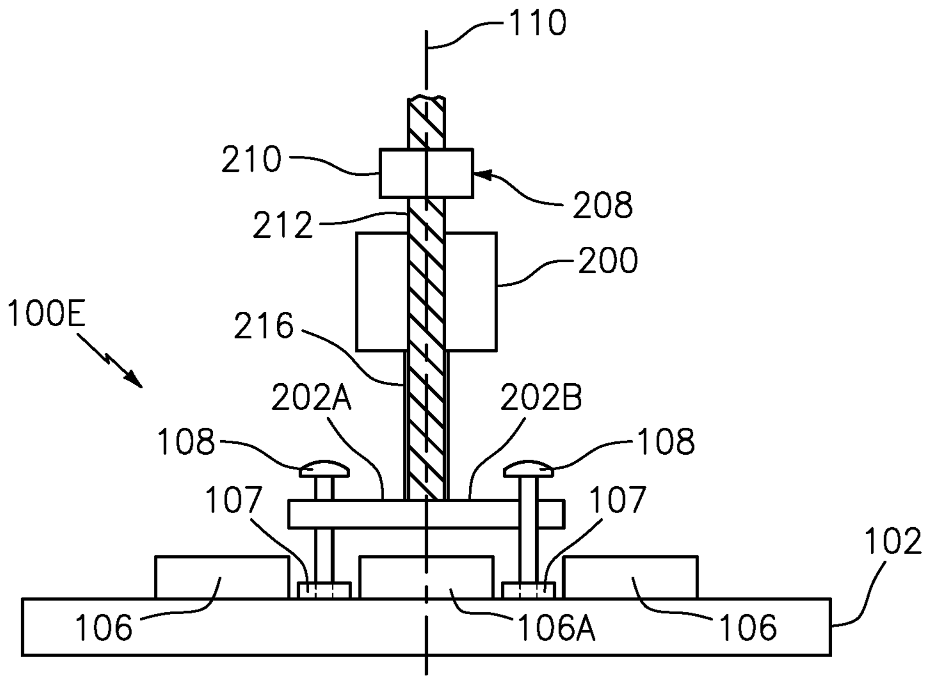
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FIG. 7

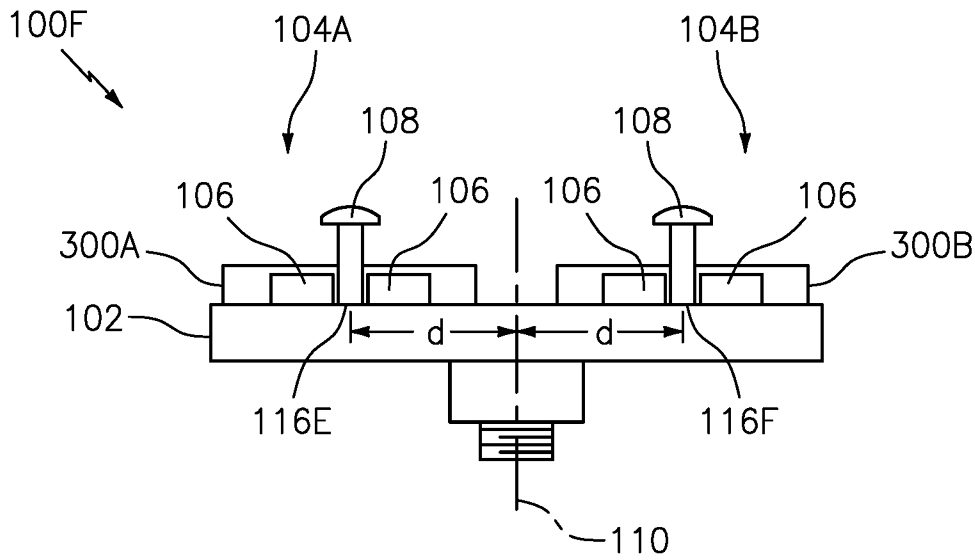
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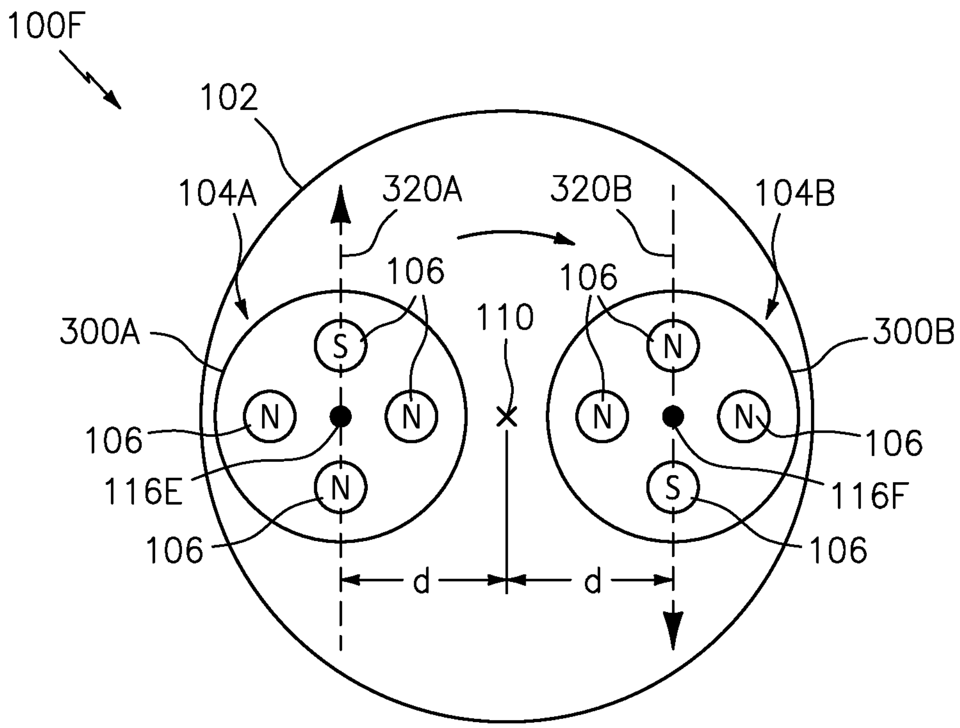
FIG. 8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d
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FIG. 9

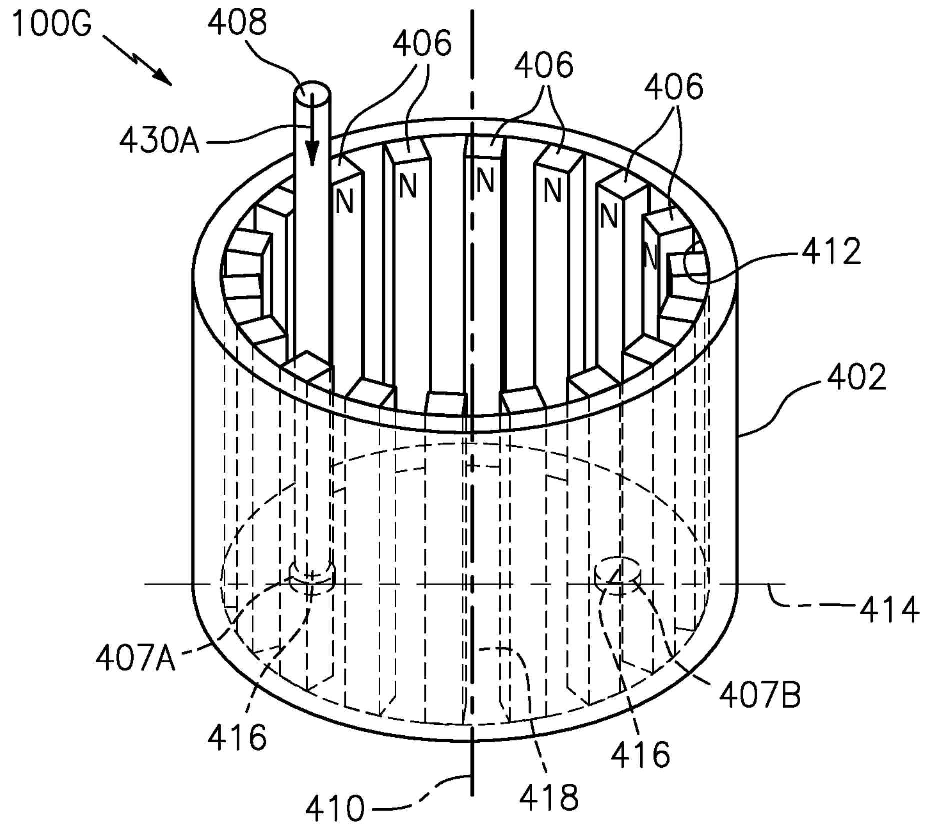
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FIG. 10

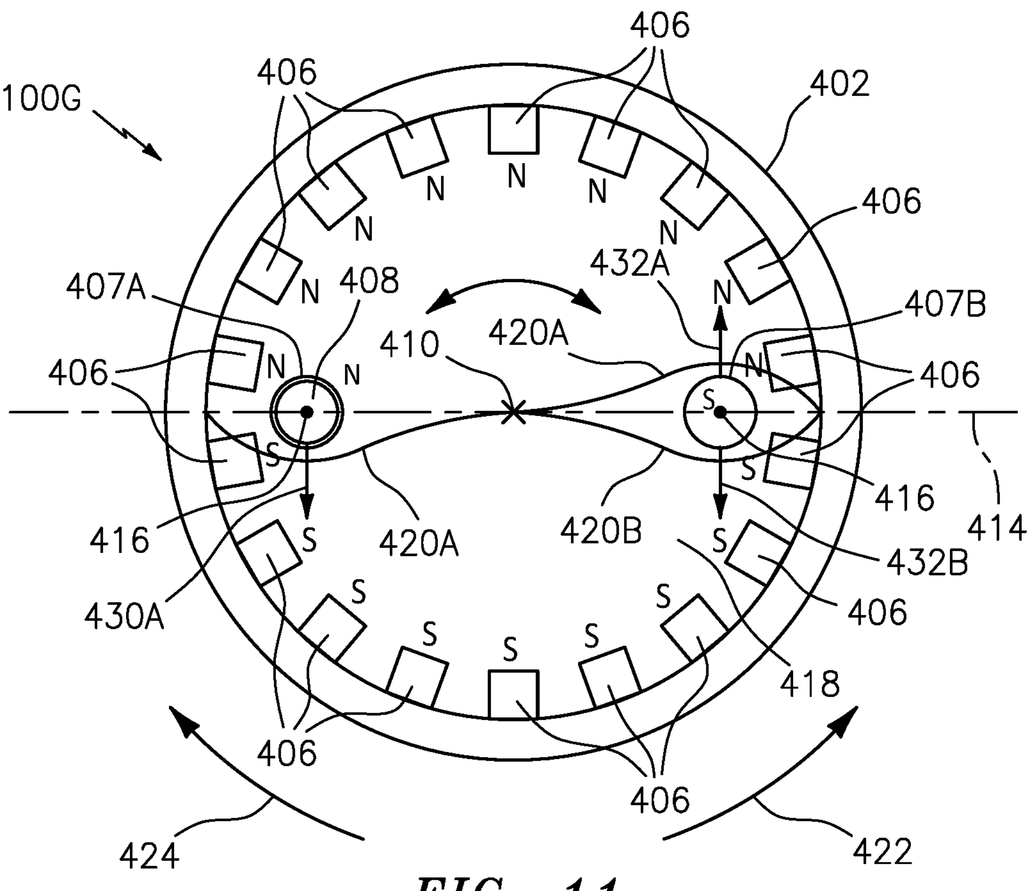
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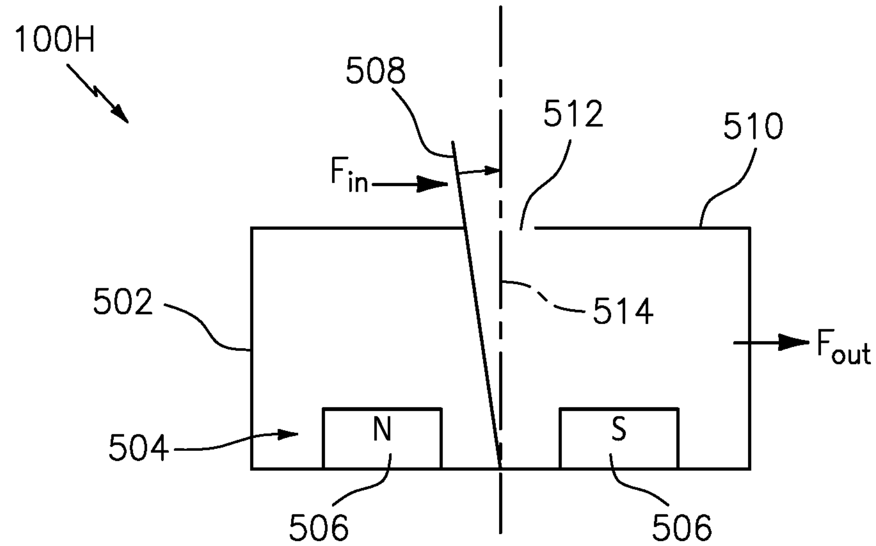
FIG. 11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506

*FIG. 12*

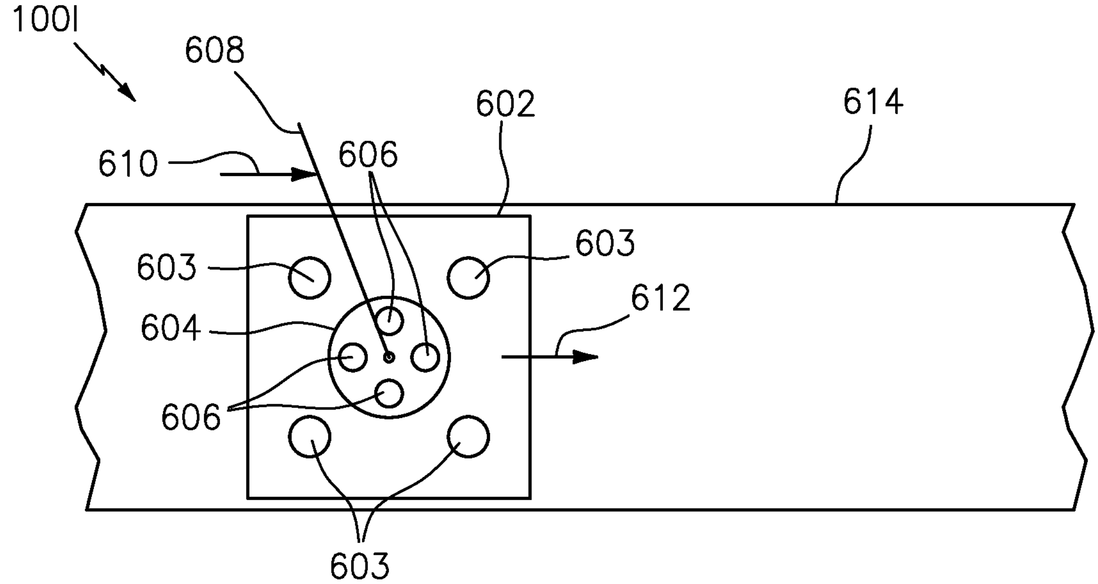
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*FIG. 13*