



US012614962B1

(12) **United States Patent**
Murphy

(10) **Patent No.:** **US 12,614,962 B1**
(45) **Date of Patent:** **Apr. 28, 2026**

(54) **MAGNETIC GEARS AND GEARING
SYSTEM EMPLOYING MAGNETIC GEARS**

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(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 242 days.

(21) Appl. No.: **18/210,676**

(22) Filed: **Jun. 16, 2023**

Related U.S. Application Data

(60) Provisional application No. 63/353,025, filed on Jun.
17, 2022.

(51) **Int. Cl.**
F16H 1/00 (2006.01)
H02K 49/10 (2006.01)

(52) **U.S. Cl.**
CPC **H02K 49/102** (2013.01)

(58) **Field of Classification Search**
CPC H02K 49/00; H02K 49/02; H02K 49/06;
H02K 49/10; H02K 49/102; H02K
49/104; H02K 49/106; H02K 49/108;
H02K 49/12; H02K 51/00; F16H 1/00;
F16H 1/02; F16H 35/00; F16H 55/00;
F16H 55/06; G09F 7/00; G09F 7/04
See application file for complete search history.

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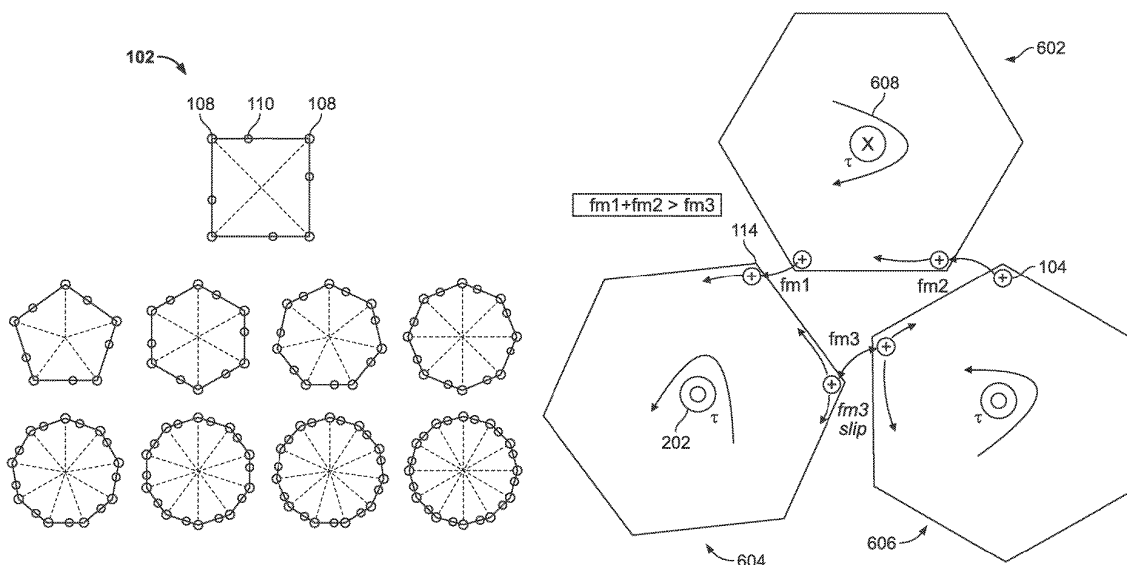
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(57) ABSTRACT

Described herein are gears having magnetic properties with
strategic positioning of the magnetic portion(s) of the gears.
This allows for multiple gears to be used in a gearing system
without the need for the gears to touch thereby eliminating
the need for lubricants and limiting wear on the gears in the
system while also reducing heat generated by the system and
the need for additional cooling systems.

17 Claims, 8 Drawing Sheets



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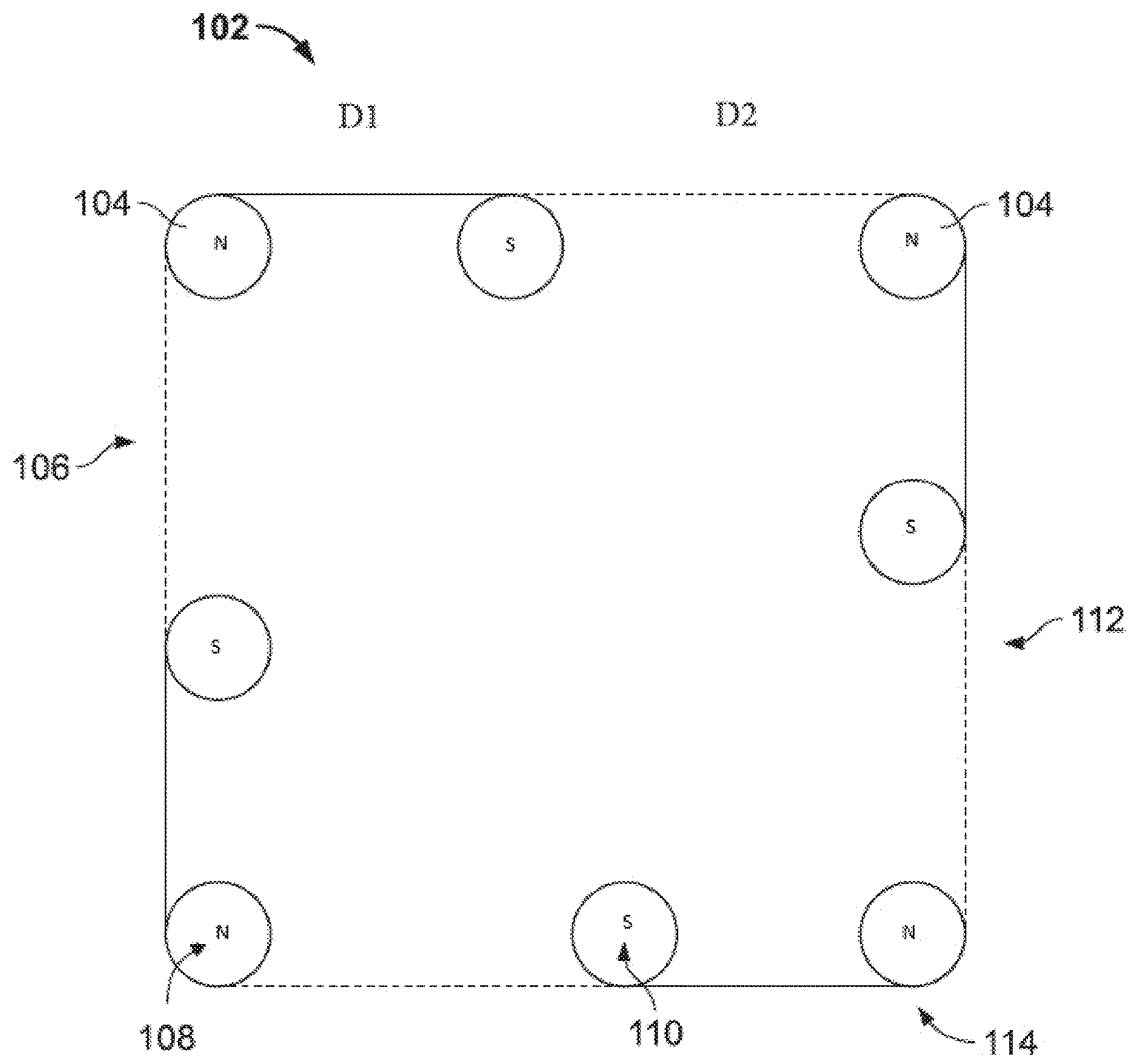


FIG. 1

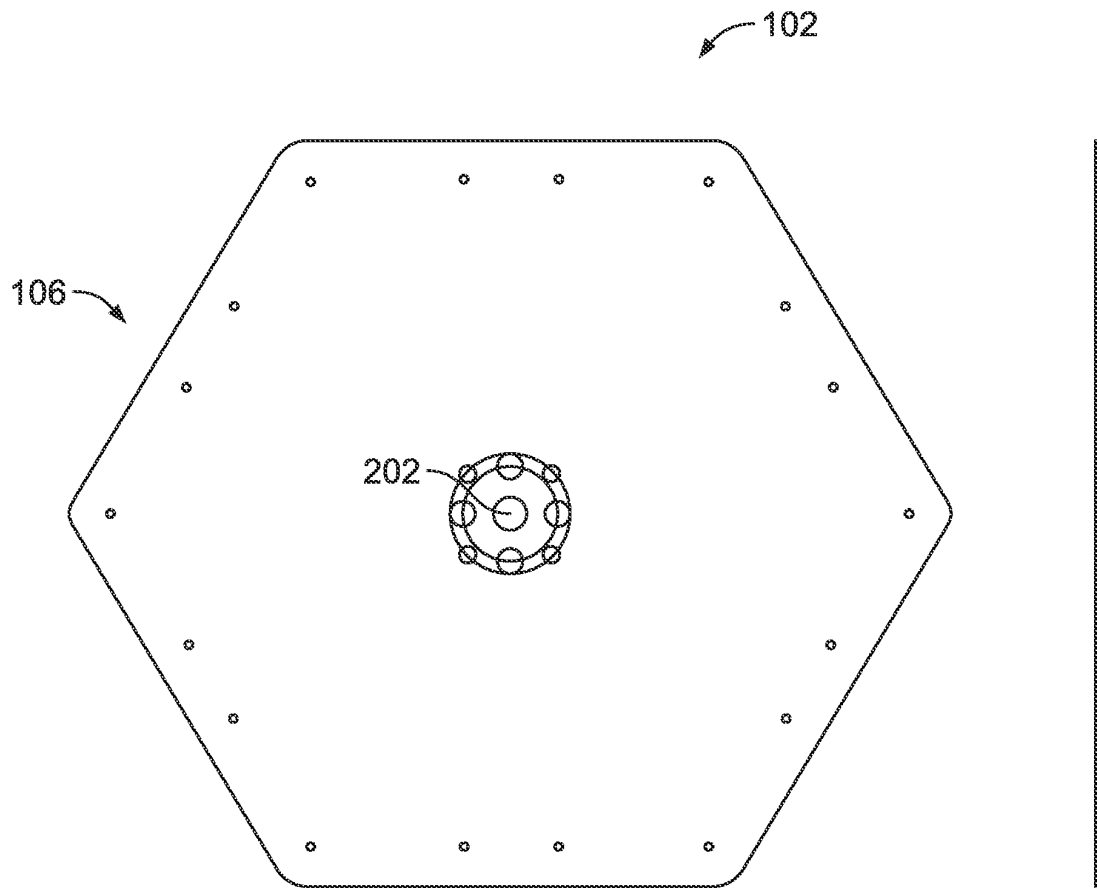


FIG. 2

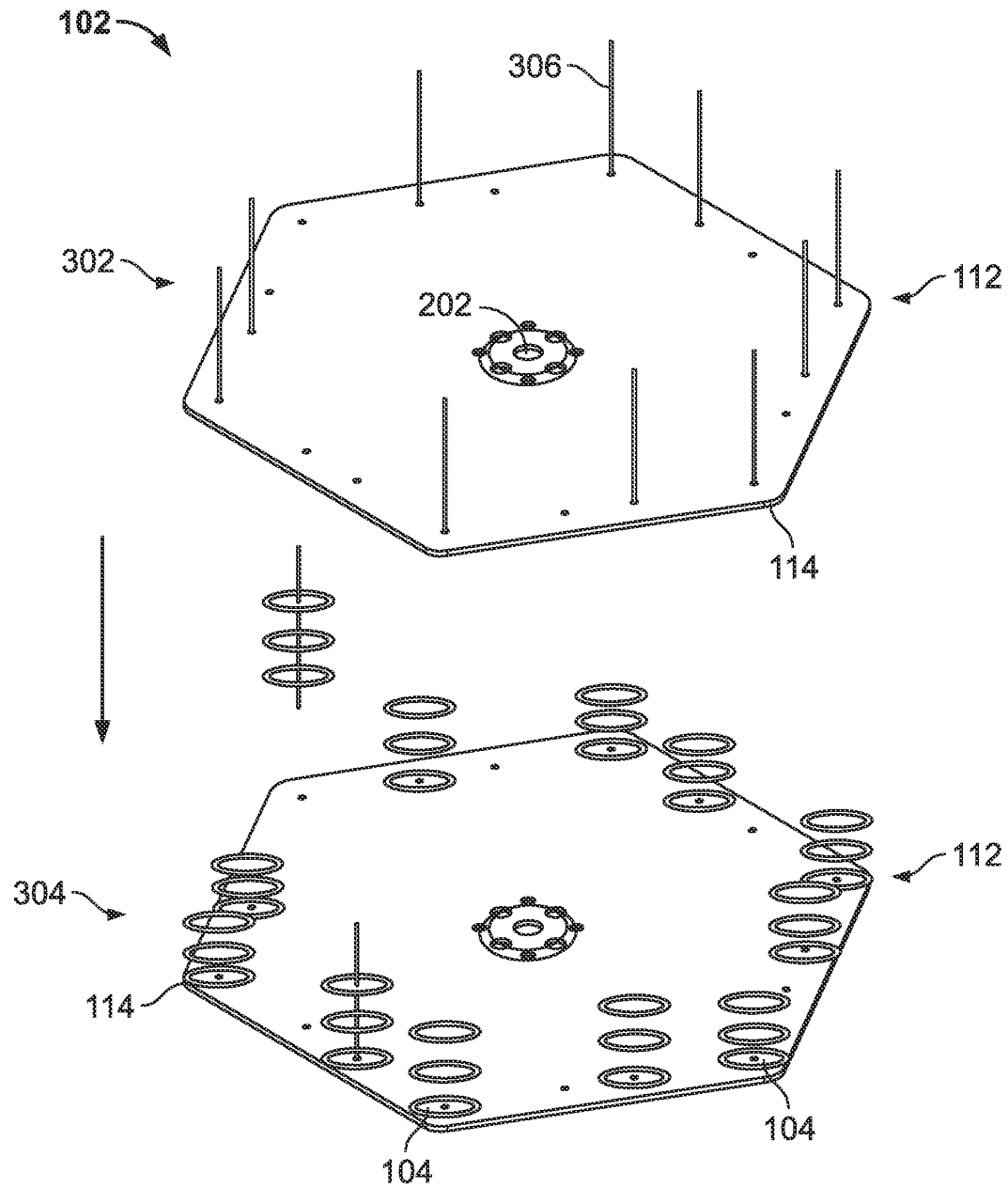


FIG. 3

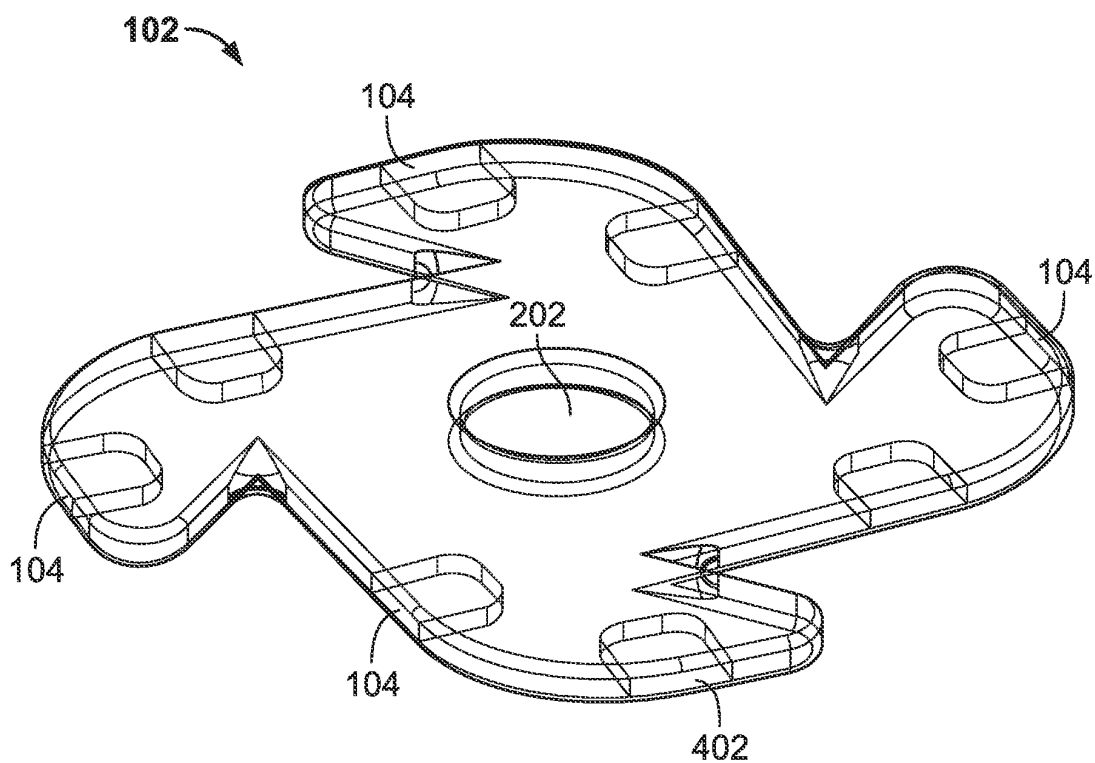


FIG. 4

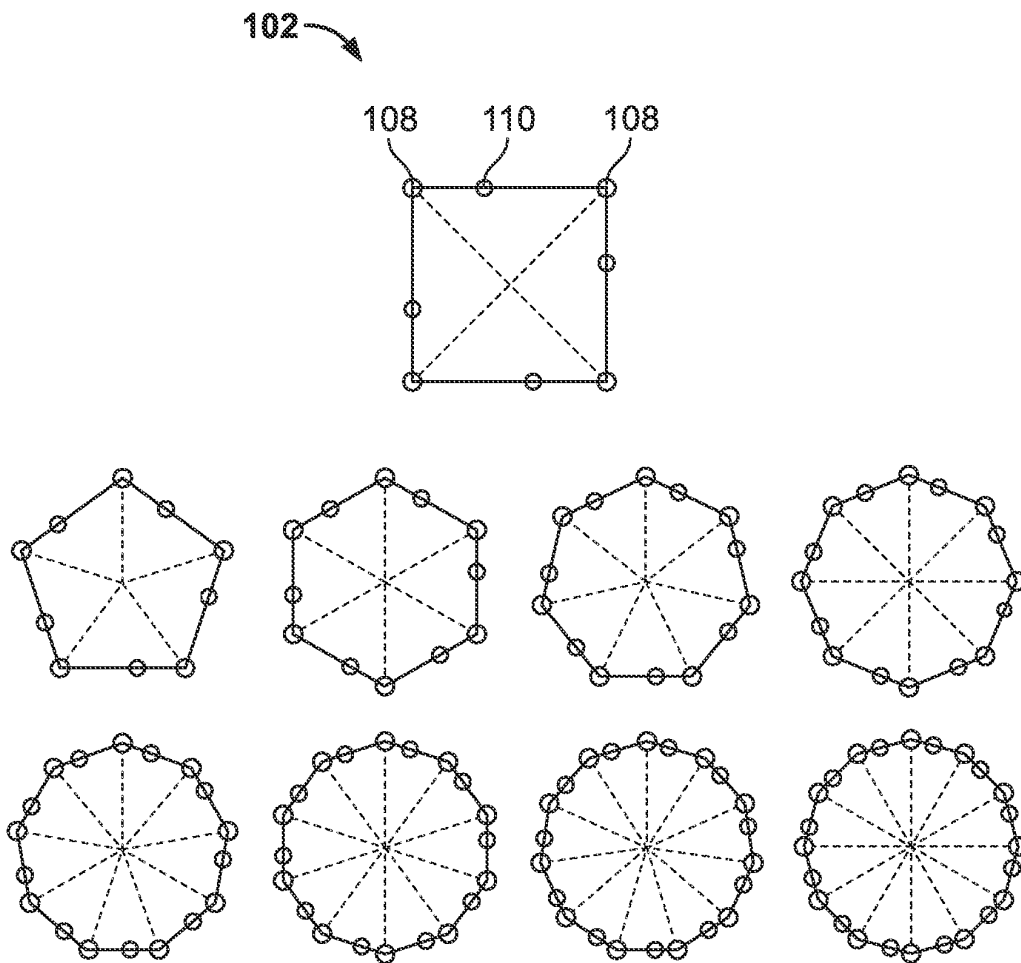


FIG. 5

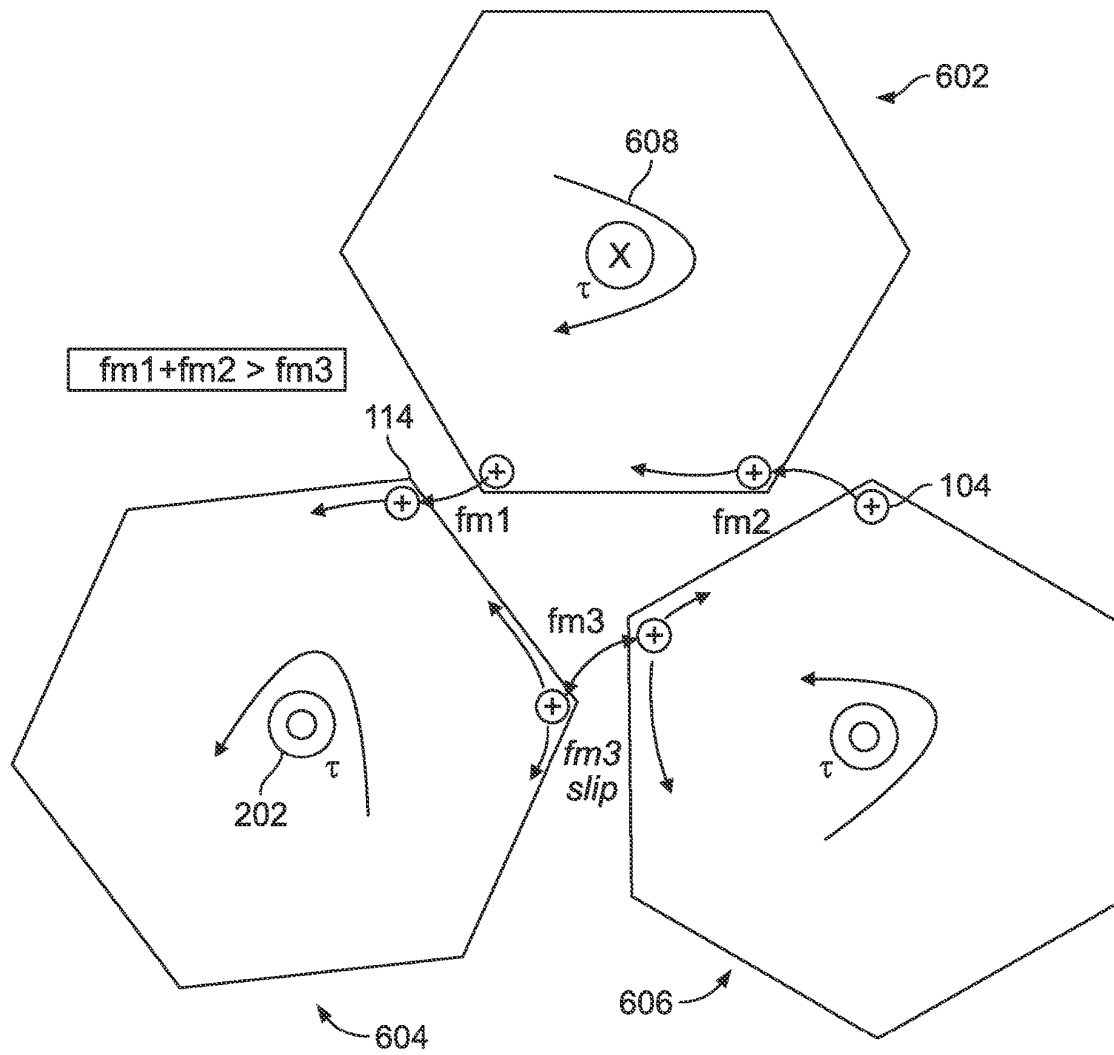


FIG. 6

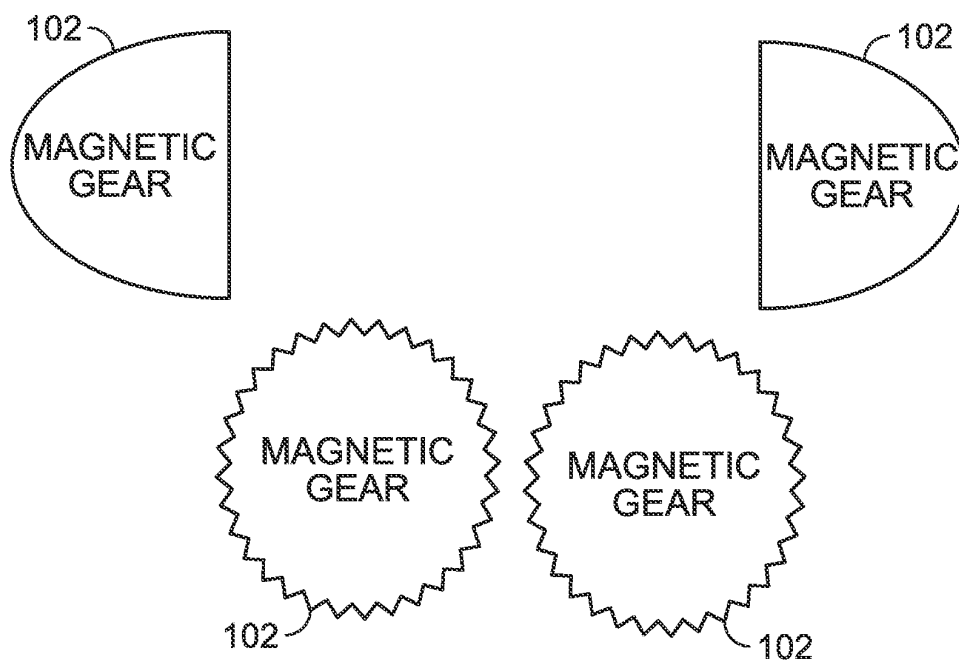


FIG. 7

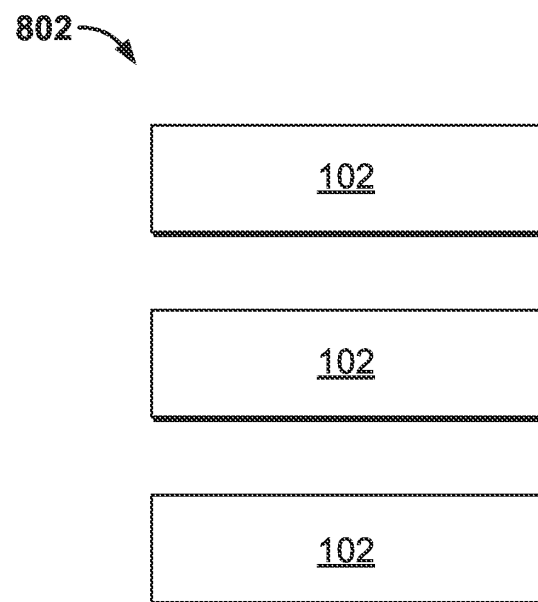


FIG. 8

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MAGNETIC GEARS AND GEARING SYSTEM EMPLOYING MAGNETIC GEARS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Application Ser. No. 63/353,025, filed on Jun. 17, 2022, the entire contents of which are herein fully incorporated by reference in its entirety.

FIELD OF THE EMBODIMENTS

The field of the present invention and its embodiments relate to gears having magnetic properties and systems employing those gears. In particular, the present application relates to magnetic gears having strategically positioned magnetic elements to allow for non-traditional gearing configurations and uses to be realized.

BACKGROUND OF THE EMBODIMENTS

Gears have been used in mechanical devices for centuries. The origin of gears can be traced back to early China. Gears and gear systems can be used in many diverse types of mechanical devices and for many different purposes. For example, gears can be used in vehicle transmissions, wind turbines, elevators, clocks, helicopters, and the like.

Many geared systems function by having at least one rotating member for engagement with another member. The problem with such physical contact (engagement) is that there is often the problem of jamming of the gears, loss of lubrication, deleterious particles, and matter getting in between the gears, and the wearing down of the gears and other system components by friction. There are also situations where the angles of rotation of the gears with respect to each other must change during operation. In order to overcome these issues, magnetic gears and gear systems have been created. These gear systems are generally contactless and frictionless. Therefore, magnetic gears and gear systems lose less energy and experience less stress than traditional gears and gear systems.

As noted herein, there have been attempts to create various magnetic gearing systems. Some of which disclose magnetic gear systems in which the magnets are positioned such that one pole is on the outside of a singular gear. This means that the gear has either an all north or an all south polarity. The other gear in the system will either have the same or opposite polarity on the outside of the gear, depending on if the gear system uses attraction or repulsion. Yet other magnetic gearing systems use an alternating polarity structure.

However, the known magnetic gearing systems incorporate magnet arrangements that fail to optimize the magnetic fields and potential energy of the magnets. Accordingly, what is needed is a magnetic gear system that has a magnet arrangement that maximizes the use of the magnetic fields and potential energy of the magnets to aid the transfer of energy through the magnetic gear system.

This is achieved by using magnetic gears and systems employing the same having a reduction in friction, a reduction in heat generated, a quieter operation of a gearing system that lacks physical contact between the gears, and the lack of lubricants or other materials required to keep the system working at an optimal pace.

Review of Related Technology

U.S. Pat. No. 10,090,749 pertains to a magnetic gear system. The magnetic gear system incorporating magnetic

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gears includes at least one end plate and at least one axle coupled to the at least one end plate. A plurality of magnet holders are also coupled to the at least one end plate. At least one magnet is contained in each of the plurality of magnet holders. Wherein the at least one magnet comprises two opposite polarities and the plurality of magnet holders are coupled to the at least one end plate with the at least one magnet having at least one polarity adjacent a similar polarity of another of the at least one magnet.

U.S. Patent Application Publication 2017/0271970 pertains to a magnetic gear system that includes magnetic gearboxes where one of a driving gear and a driven gear are in sequential magnetic linkage, and one of the magnetic gears can be tilted relative to the other gear wherein the magnetic gears are prevented from overlapping each other to prevent loss of sequential magnetic interaction. A magnetic gearbox is also disclosed where a driving gear can be tilted relative to a driven gear to change the torque, the rotational speed of the driven gear, and if tilted far enough, to change the direction of rotation of the driven gear. Another magnetic gearbox includes a pair of magnetic gears that can be manipulated to result in a reversal of the direction of rotation of a driven gear from a driving gear without changing the magnetic properties of either gear. A gearbox is also described that includes a magnetic gear irrotationally mounted on one shaft and a set of gears on another shaft, wherein the one gear is in sequential magnetic interaction with the set of gears to alter the rotational speed of either the one gear or the set of gears. A pair of magnetically linked magnetic gears is described as having equal diameters but unequal numbers of magnetic gears.

International Application Publication WO2021/169138 pertains to a disc-type permanent-magnet gear and a disc-type permanent-magnet gear-based transmission structure. The disc-type permanent-magnet gear comprises a gear base disc, a transmission shaft that penetrates the middle of the gear base disc, and a plurality of permanent magnets embedded in the gear base disc. The permanent magnets are distributed along the circumference of the gear base at uniform intervals; magnetic poles of all the permanent magnets are exposed on at least one side round surface of the gear base, and all the magnetic poles of the permanent magnets exposed on the same side surface of the gear base have the same polarity. The disc-type permanent-magnet gear achieves transmission torque by only using one group of permanent magnets having the same arrangement direction of magnetic poles on existing permanent-magnet gears; at the same time, the disc permanent-magnet gear achieves transmission by means of a repulsion force between magnetic poles having the same polarity, which increases the magnetic transmission force, reduces changes to the magnetic field as a result of changes to the magnetic poles during rotation, and prevents the occurrence of sudden vibration in transmission.

European Patent Application Publication 1069671 pertains to a magnetic gear train comprising two or more members rotatable about a corresponding axis, each axis being equipped with a plurality of magnets circumferentially spaced along their periphery and projecting therefrom. The magnetic axes of the permanent magnets are in planes perpendicular to the axes of rotation, and are further inclined to the radial direction of the corresponding rotatable member.

Thus, there is a need for magnetic gears and a system employing said magnetic gears to provide enhanced gearing systems that create less wear on the gears and allow for

non-traditional gearing relationships. The present invention and its embodiments meet and exceed these needs.

SUMMARY OF THE EMBODIMENTS

In general, the present application and its embodiments relate to magnetic gears and a system employing multiple magnetic gears as described herein. The magnetic gears allow for an alternating polarity of a plurality of magnets to be disposed along a periphery of a gear body. Magnets are preferably located at each vertex of the gear body with each gear body having about four to twenty vertices. Between the vertices is located another magnet that is biased (located closer) towards one of the two vertices it is positioned between. Such a relationship allows for a gearing system employing the magnetic gears of the present application to have superior performance and characteristics over known magnetic gear systems. Further, the magnetic gearing systems employing gears of the present application can be used to create arrays of gears in differing planes without loss of efficiencies.

In one aspect of the present application, there is a magnetic gear having a plurality of magnets, a magnet retaining structure configured to secure a position of each of the plurality of magnets relative to the magnet retaining structure, where the magnet retaining structure includes a body having a periphery, where one magnet of the plurality of magnets is positioned at each vertex of the body and one magnet of the plurality of magnets is positioned between the magnets located at each vertex, and where the magnet located between the magnets located at each vertex is biased toward one vertex.

The magnetic gear may also include a central aperture located in the body.

The magnetic gear may also include where the body has at least three vertices.

The magnetic gear may also include where the body includes a first body and a second body.

The magnetic gear may also include where the plurality of magnets are configured to reside between the first body and the second body.

The magnetic gear may also include where a polarity of the plurality of magnets is arranged in an alternating fashion.

The magnetic gear may also include where the magnet located between magnets at the vertices splits the difference between the magnets at about a 40:60 split.

In yet another aspect of the present application, there is a magnetic gear having a plurality of magnets, a magnet retaining structure configured to secure a position of each of the plurality of magnets between a first body and a second body, where the first body and the second body have a substantially identical periphery and are configured to be secured to one another, where the plurality of magnets are disposed along a periphery of the first body with a polarity of each magnet being of an opposing polarity in relation to the magnet on either side of the magnet, where a magnet of the plurality of magnets is positioned at each vertex of the periphery and one magnet of the plurality of magnets is positioned between the magnet located at each vertex, and where the one magnet located between the magnet located at each vertex splits a distance between two vertices in about a 40:60 split.

The magnetic gear may also include where the magnetic gear is a quadrilateral.

The magnetic gear may also include where the magnetic gear is a hexagon.

The magnetic gear may also include where more than one magnet is located at a position on the magnetic gear.

The magnetic gear may also include a plurality of securement mechanisms configured to secure the first body to the second body.

In yet another aspect of the present application, there is a magnetic gear system having a first magnetic gear that includes a plurality of magnets, a magnet retaining structure configured to secure a position of each of the plurality of magnets relative to the magnet retaining structure, where the magnet retaining structure includes a body having a periphery, where one magnet of the plurality of magnets is positioned at each vertex of the body and one magnet of the plurality of magnets is positioned between the magnets located at each vertex, and where the magnet located between the magnets located at each vertex is biased toward one vertex. The magnetic gear system also includes a second magnetic gear having a plurality of magnets, a magnet retaining structure configured to secure a position of each of the plurality of magnets relative to the magnet retaining structure, where the magnet retaining structure includes a body having a periphery, where one magnet of the plurality of magnets is positioned at each vertex of the body and one magnet of the plurality of magnets is positioned between the magnets located at each vertex, and where the magnet located between the magnets located at each vertex is biased toward one vertex.

The magnetic gear system may also include a third magnetic gear having a plurality of magnets, a magnet retaining structure configured to secure a position of each of the plurality of magnets relative to the magnet retaining structure, where the magnet retaining structure includes a body having a periphery, where one magnet of the plurality of magnets is positioned at each vertex of the body and one magnet of the plurality of magnets is positioned between the magnets located at each vertex, and where the magnet located between the magnets located at each vertex is biased toward one vertex.

The magnetic gear may also include where the body has anywhere from four to twenty vertices.

The magnetic gear may also include where the quadrilateral is a square.

The magnetic gear may also include where the hexagon-shaped magnetic gear contains twelve magnets.

The magnetic gear system may also include where the first magnetic gear, the second magnetic gear, and the third magnetic gear are oriented to cause magnets of the same polarity to repel one another when the first magnetic gear, the second magnetic gear, and the third magnetic gear are rotated about a central axis.

The magnetic gear system may also include where the first magnetic gear, the second magnetic gear, and the third magnetic gear are oriented parallel to one another in differing planes.

The magnetic gear system may also include where the first magnetic gear, the second magnetic gear, and the third magnetic gear are oriented in differing horizontal and vertical planes.

The present application and its embodiments allow for as many additional gears as needed to be added into the total system.

The present application and its embodiments allow for the transfer of torque applied to a magnetic gear which then, by the work of magnetic fields, and no physical contact, transfers the torque to another magnetic gear.

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The present application and its embodiments allow for a sleek, minimalist, and fixed design that features openings to allow for different attachment parts to be added to the magnetic gear.

The present application and its embodiments allow for an array of the present application to be scaled to any symmetrical size in the X and Y plane, as long as the ratio of its parts and magnet spacing remains the same.

The present application and its embodiments allow for magnetic gears to be aligned vertically along the central axis, and by way of magnetic coupling and not physical contact, the like-poles will attract, creating a uniform motion in a specific direction.

Other technical features may be readily apparent to one skilled in the art from the following figures, descriptions, and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

To easily identify the discussion of any particular element or act, the most significant digit or digits in a reference number refer to the figure number in which that element is first introduced.

FIG. 1 illustrates an embodiment of a magnetic gear in accordance with the present application.

FIG. 2 illustrates a second embodiment of a magnetic gear in accordance with the present application.

FIG. 3 illustrates a third embodiment of a magnetic gear in accordance with the present application.

FIG. 4 illustrates a fourth embodiment of a magnetic gear in accordance with the present application.

FIG. 5 illustrates the positioning of magnets upon magnetic gears having exemplary shapes.

FIG. 6 is a diagram illustrating a magnetic slipping alignment of an embodiment of the present application.

FIG. 7 illustrates an embodiment of an exemplary magnetic array.

FIG. 8 illustrates a second embodiment of an exemplary magnetic array.

DETAILED DESCRIPTION OF THE EMBODIMENTS

The preferred embodiments of the present invention will now be described with reference to the drawings. Identical elements in the various figures are identified with the same reference numerals.

Reference will now be made in detail to each embodiment of the present invention. Such embodiments are provided by way of explanation of the present invention, which is not intended to be limited thereto. In fact, those of ordinary skill in the art may appreciate upon reading the present specification and viewing the present drawings that various modifications and variations can be made thereto.

As used herein, the term “about” is meant to signify the variable specified+10%. Thus, if the specified variable is a 40:60 ratio then the term “about” would cover a range of 30:70 to 50:50.

Referring now to FIG. 1, there is a first embodiment of a magnetic gear **102** having a plurality of magnets **104**, a gear body **106**, a positive polarity **108**, a negative polarity **110**, a periphery **112**, and a vertex **114**.

The magnetic gear **102** of the present application utilizes both magnetic repulsion and attraction simultaneously, when interacting with one or more additional magnetic gears **102**, to create angular momentum around a central axis (see FIG. 2). With a plurality of magnets **104** disposed on each

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magnetic gear **102**, an individual magnetic gear **102** can spin in either clockwise or counter-clockwise direction. At any one moment, two positive (+) magnetic poles are configured to repel each other, while a third negative (−) magnetic pole (located between the two positive magnetic poles) attracts the others, on a second magnetic gear (see FIGS. 6-8), to guide their spin, limiting and/or preventing any recoil from said magnetic interaction. Whether the positive pole magnet of the two is trailing the other, in the established spin direction, is the magnet that is pushing the other forward, known as the “trailing magnet.” As the trailing magnet repels the first magnet forward, known as the “lead magnet”, a third negative magnetic pole, known as the “guide magnet”, situated in sequence next to the positive pole lead magnet, attracts the trailing magnet, guiding the trailing magnet forward. This guide magnet helps the trailing magnet to continue to propel the lead magnet forward so it can then repel a new, fourth, positive magnet pole forward. The lead magnet becomes the trailing magnet in the subsequent connection. Simultaneously, the original trailing magnet will become a lead magnet in its next interaction brought on by the next positive magnetic pole in sequence, which is guided by the next negative pole magnet in sequence situated next to the positive pole lead magnet, formally known as the trailing magnet in the previous connection.

The gear body **106** may be formed from any suitable material that is non-reactive (non-magnetic) with the plurality of magnets **104** disposed therein. Preferred materials include polymers such as but not limited to polyethylene terephthalate (PET), polyethylene (PE), high-density polyethylene, polyvinyl chloride (PVC), polyvinylidene chloride (PVDC), low-density polyethylene (LDPE), polypropylene (PP), polystyrene (PS), high impact polystyrene (HIPS) and polycarbonate (PC), or any combination thereof. Other materials such as composites and certain metals may also be used. Composites may include but are not limited to fiber-reinforced plastics, metal composites, carbon fiber, Kevlar® and the like. Metals may comprise lightweight metals such as aluminum and other pure metals as well as various alloys.

The plurality of magnets **104** are preferably rare earth magnets such as neodymium or samarium cobalt magnets. Other types of permanent magnets such as composite magnets, nano-structured magnets, electromagnets, and single-molecule magnets. Advantageously, electromagnets may be turned “on” or “off” by the application of an electric current. Further, the amount of electric current supplied can further modify the magnetic field generated by such a magnet or group of magnets.

As shown in FIG. 1, the plurality of magnets **104** are spaced around a periphery **112** of the gear body **106**. The magnets having a positive polarity **108** are located in the vertices **114** and the magnets having a negative polarity **110** are located in between two magnets having a positive polarity **108** on the vertices **114**. In other embodiments, the negative polarity **110** magnets may be in the position of the positive polarity **108** magnets as shown in FIG. 1.

However, the magnet having a negative polarity **110** (or positive polarity **108** depending on the configuration) is not situated equidistant from the two other magnets it is positioned between. D1 and D2 represent the distances from the magnet having a negative polarity **110** to each of the respective vertices **114**. D1 is equal to about 40% of the total distance from vertex **114** to vertex **114**, whereas D2 is equal to about 60% of the distance from vertex **114** to vertex **114**. For example, if the length from vertex **114** to vertex **114** as shown in FIG. 1 is three (3) inches, then the middle magnet

or magnet having a negative polarity **110** is located **D1** (1.25 inches) from one vertex, and **D2** (1.75 inches) from the other vertex.

Referring now to FIGS. **2** and **3**, there is another embodiment of a magnetic gear **102**. Here, the gear body **106** is hexagonal in shape. Further, there is a central aperture **202** to allow for mounting of the magnetic gear **102** or to receive input from a drivetrain of a motor (not shown). Additionally, bearings may be used to further facilitate the rotation of the magnetic gear **102**.

As shown in FIG. **3**, the magnetic gear **102** comprises a first body **302** and a second body **304**. Each of the first body **302** and the second body **304** are preferred to be substantially identical to one another. In some embodiments, there may be some desired differences, but the overall principles must remain the same in order to accurately maintain about the 40:60 configuration as described in relation to FIG. **1**. For example, there may be one a first body **302** and no second body **304** as part of the magnetic gear **102**. Additionally, the gear may take various forms and have portions removed (e.g. forming a wheel with spokes) to reduce weight and modify other variables within the system. Virtually any shape and configuration of the gear(s) may be used within the purview of the present application as long as those principles otherwise discussed herein are met.

The plurality of magnets **104** are disposed between the first body **302** and the second body **304**. There may be slots (see FIG. **4**) to receive each of the plurality of magnets **104**. Such slots may be recesses on each of the first body **302**, the second body **304**, or a combination thereof. The slots may allow for more than one magnet to be positioned within each slot or for magnets to be interchanged or removed to modify the functionality of the magnetic gear **102**. Once the magnets have been positioned, securement mechanisms **306** may be utilized to join the first body **302** and the second body **304** thereby forming the gear body **106**. Once assembled, the gear body **106** may be used in an array as will be further described herein.

As previously described, the plurality of magnets **104** are preferably rare earth magnets such as neodymium or samarium cobalt magnets or permanent magnets such as composite magnets, nano-structured magnets, electromagnets, and single-molecule magnets.

In other embodiments, electromagnets may be employed in such an embodiment.

FIG. **4** illustrates yet another embodiment of the present application. Here, the magnetic gear **102** is shown with various slots or hollows **402**. Each of the hollows **402** can be tilted, rotated, and turned in any of the x, y, and/or z directions to any angle (from 0°-360°) to help aid magnetic coupling between multiple magnetic gears **102** in any the alignments of the gears as described herein. This is preferably done by making changes to any of the individual hollows **402** for the plurality of magnets **104** and not the outer visible structure of the gear body **106**. This, in turn, allows for specific design adjustments for different applications, as also shown with the embodiment in FIG. **3**, without the need for a complete magnetic gear **102** redesign.

As previously described herein and as shown in FIG. **5**, the magnetic gears **102** of the present application may take on varying form factors. It is preferable that the magnetic gears **102** take on polygonal shapes, but irregular shapes may also be utilized under the purview of the present application. Shown here are exemplary magnetic gears **102**, magnets having a positive polarity **108**, and magnets having a negative polarity **110**. The magnetic gears **102** shown herein are polygonal and have a number of sides varying

from four to twelve sides. However, an embodiment of the present magnetic gears **102** may have more or fewer sides and preferably ranges from at least three sides to at least twenty sides.

Referring now to FIG. **6**, shown are three magnetic gears configured in a triangular alignment. Shown is the triangular gear alignment having a plurality of magnets **104**, a vertex **114** or vertices **114**, a central aperture **202**, a first magnetic gear **602**, a second magnetic gear **604**, a third magnetic gear **606**, and a direction of rotation **608**. The three gears can spin in unison in a triangular alignment without contact using magnetic coupling, which is not possible with mechanical gears that require contact. Torque transfers from the magnetic gear that is attached to a motor to the other two gears in the magnetic gear system.

In order to achieve this torque transfer, there is to be a magnetic “2:1 slipping” between the two gears moving with the same angular momentum or direction of rotation **608** and the third spinning magnetic gear having an opposing direction of rotation **608**. When accomplished the FM1 and FM2 is greater than the FM3 as indicated which causes the slipping thereby allowing the like polarity magnets to move past each other without a loss of torque.

This triangular pattern can be repeated “n” number of times, creating multiple magnetic slips, without affecting RPM and torque transfer. One implementation of such a practical usage of this type of arrangement is a regenerative motor, containing at least two output motors, a drive shaft, and multiple generators where “n” number of gears can be added in sequence through magnetic coupling (in any alignment).

Referring now generally to FIGS. **7** and **8**, the magnetic gears **102** of the present application take advantage of the ability to form a magnetic array using a specific spacing of the plurality of magnets **104** around the periphery **112** of the gear body **106**. The magnetic arrays of the present application can be applied to any geometric shape (including three-dimensional shapes) as long as spacing, and scaling is maintained. One gear can rotate another gear without contact using magnetic coupling (both repulsion and attraction) as described herein. Torque transfers from one magnetic gear **102** attached to a motor (not shown) to a second magnetic gear **102**. The two gears can be aligned in multiple gear-orientations without contact using magnetic coupling. Said gear-orientations may include but are not limited to parallel axis, intersecting axis, nonparallel nonintersecting axis, and linear rack alignment. Each gear-orientation may be achieved without changing the magnet array pattern or gear design.

In the magnetic gear arrays, such as a first magnetic array **702** or the second magnetic array **802** as shown, a transfer of torque applied to the magnetic gear **102** operably coupled to the motor, which then, by the work of magnetic fields, and no physical contact, transfers the torque to another magnetic gear **102** through multiple axial orientation arrangements.

As shown in FIG. **7**, there is a first magnetic array **702** comprised of multiple magnetic gears **102** of varying orientations. One of the magnetic gears **102** is to be driven by a motor (not shown) and the other magnetic gears **102** are oriented and spaced such that the motor-driven magnetic gear **102** can rotate a second magnetic gear **102** without touching it. The same trend continues for the other gears in the array.

As shown in FIG. **8**, there is a second magnetic array **802** that has the magnetic gears **102** stacked in a Z-axis without contacting any of the respective magnetic gears **102** in the array. By using magnetic coupling and acting as one large

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gear along a center shaft, this allows the second magnetic array **802** to increase magnetic pull/push force.

By aligning the magnetic gears **102** vertically along the central axis, and by way of magnetic coupling, the like-poles (positive/positive and/or negative/negative) will attract, creating a uniform motion in a specific direction. This is referred to herein as “stacking.” Each individual magnetic gear **102** added to the second magnetic array **802**, in vertical, will all function as one gear moving in unison. Further, this “stacking” principle can be used with different sized magnetic gears **102** as long as the scaling is consistent. This allows for the magnetic gears **102** to be stacked in a custom order of size to allow maximum utility.

In general, any of the magnetic gears **102** described herein can be scaled to any symmetrical size in the X and Y plane, as long as the ratio of the parts and array spacing remains the same. Additionally, a thickness of the magnetic gears **102** can be increased as desired along the Z axis to create a longer, cylindrical-like frame. This is a specific feature that compounds the application of the wheel for larger loads but does not affect the integrity of the array in and of itself. In other embodiments, by extending the gear along the Z axis may create a sphere-like array comprising more than one similarly or differently shaped gear.

Although this invention has been described with a certain degree of particularity, it is to be understood that the present disclosure has been made only by way of illustration and that numerous changes in the details of construction and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention.

What is claimed is:

1. A magnetic gear comprising:

a first plurality of magnets including first magnets and second magnets;

a magnet retaining structure having a body with a periphery and more than one vertices,

wherein the magnet retaining structure is configured to secure a position of each of the plurality of magnets relative to the magnet retaining structure,

wherein one first magnet of the first magnets is positioned between two respective adjacent vertices of the body, wherein one second magnet of the second magnets is located at each vertex of the two respective adjacent vertices, and

wherein the one first magnet, located between the second magnets at the two respective adjacent vertices is biased toward one vertex of the two respective adjacent vertices.

2. The magnetic gear of claim 1 further comprising a central aperture located in the body.

3. The magnetic gear of claim 1 wherein the body has at least three vertices, and there is one magnet second magnet of the second magnets located at each of the at least three vertices.

4. The magnetic gear of claim 1 wherein the body comprises a first body and a second body.

5. The magnetic gear of claim 1 wherein the plurality of magnets are configured to reside between the first body and the second body.

6. The magnetic gear of claim 1 wherein the plurality of magnets are arranged such that an N polarity of one of the plurality of magnets is adjacent to an S polarity of another of the plurality of magnets.

7. The magnetic gear of claim 3 wherein the body has four to twenty vertices, and there is one second magnet of the second magnets located at each vertex present in the body.

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8. The magnetic gear of claim 1 wherein the magnet located between the two respective adjacent vertices is biased toward one vertex of the two respective adjacent vertices at a distance ratio of 40:60.

9. A magnetic gear comprising:

a plurality of magnets;

a magnet retaining structure configured to secure a position of each of the plurality of magnets between a first body and a second body,

wherein the first body and the second body have a substantially identical periphery and are configured to be secured to one another,

wherein the plurality of magnets are disposed along a periphery of the first body with a polarity of each magnet being of an opposing polarity in relation to the magnet on either side of the magnet,

wherein a magnet of the plurality of magnets is positioned at each vertex of the periphery and one magnet of the plurality of magnets is positioned between the magnet located at each vertex, and

wherein the one magnet located between the magnet located at each vertex splits a distance between two vertices in a 40:60 split.

10. The magnetic gear of claim 9 wherein the magnetic gear is a quadrilateral.

11. The magnetic gear of claim 10 wherein the quadrilateral is a square.

12. The magnetic gear of claim 9 wherein the magnetic gear is a hexagon.

13. The magnetic gear of claim 12 wherein the hexagon-shaped magnetic gear contains twelve magnets.

14. The magnetic gear of claim 9 wherein more than one magnet is located at a position on the magnetic gear.

15. The magnetic gear of claim 9 further comprising a plurality of securement mechanisms configured to secure the first body to the second body.

16. A magnetic gear system comprising:

a first magnetic gear comprising:

a first plurality of magnets including first magnets and second magnets;

a magnet retaining structure having a body with a periphery and more than one vertices,

wherein the magnetic retaining structure is configured to secure a position of each of the plurality of magnets relative to the magnet retaining structure, wherein one first magnet of the first magnets is positioned between two respective adjacent vertices of the body,

wherein one second magnet of the second magnets is located at each vertex of the two respective adjacent vertices, and

wherein the one first magnet, located between the second magnets at the two respective adjacent vertices is biased toward one vertex of the two respective adjacent vertices; and

a second magnetic gear comprising:

a second plurality of magnets including third magnets and fourth magnets;

a magnet retaining structure having a body with a periphery and more than one vertices,

wherein the magnet retaining structure is configured to secure a position of each of the plurality of magnets relative to the magnet retaining structure,

wherein one third magnet of the third magnets is positioned between two respective adjacent vertices of the body,

wherein one fourth magnet of the fourth magnets is located at each vertex of the two respective adjacent vertices, and

wherein the one third magnet, located between the fourth magnets located at the two respective adjacent vertices is biased toward one vertex of the two respective adjacent vertices.

17. The magnetic gear system of claim 16 further comprising a third magnetic gear comprising:

a third plurality of magnets including fifth magnets and sixth magnets;

a magnet retaining structure having a body with a periphery and more than one vertex,

wherein the magnet retaining structure is configured to secure a position of each of the plurality of magnets relative to the magnet retaining structure,

wherein one fifth magnet of the fifth magnets is positioned between two respective adjacent vertices of the body,

wherein one sixth magnet of the sixth magnets is located at each vertex of the two respective adjacent vertices, and

wherein one fifth magnet, located between the sixth magnets at the two respective adjacent vertices is biased toward one vertex of the two respective adjacent vertices.

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