(not shown) may be coupled to any of the rotating rings **410** in a manner similar to those described above in connection with the other embodiments.

[**0151**] The location of each gap **411** in a given ring layer is radially offset from the location of each gap **411** in adjacent ring layers. Consequently, each individual ring **410** can assist in directly driving or powering two rings **410** in the adjacent ring layers **413**. Such cooperation between the rings is illustrated by examining a given ring **420** in a given ring layer **418**. Rotation of ring **420** will drive both rings **422** and **421** in adjacent ring layer **419** since the myosin-coated surface **414** of ring **420** contacts a portion of the actin-coated surface **415** of ring **422** and a portion of the actin-coated surface **415** of ring **421**. Ring **422** in ring layer **419** in turn drives ring **423** in ring layer **418**. Each central ring (e.g., ring **427**) is stationary. Thus, the myosin-coated surface **414** of central ring **427** drives the actin-coated surface **415** of the innermost freely rotating ring **429** in adjacent ring layer **419**. Similarly, the actin-coated surface **415** of central ring **427** drives the myosin-coated surface **414** of ring **430** in the other adjacent layer. In this arrangement, the outer rings will have greater rotational speeds than the inner rings.

[**0152**] Opposing curved surfaces (e.g., surface **424**) between adjacent rings (e.g., rings **420** and **423**) in the same layer may also be coated with complementary motor proteins so that all rings surfaces can contribute to the drive power.

[**0153**] Similar to the above-described embodiment, a liquid containing a sufficient concentration of ATP is introduced between the respective planar surfaces of the ring layers. The myosin coated on the surface(s) **414** undergoes a conformation change to attach to, and move, an adjacent actin-coated surface **415**. The drive cooperation among the individual rings permits **410** substantial radial narrowing of the planar surfaces **414, 415** of the rings **410**. The decreased radial width means that substantially uniform rotational velocities are present across the planar surfaces **414, 415** of each ring **410**. Consequently, the motor protein interaction across the planar surfaces **414, 415** can occur at optimum uniform speeds, thus improving the efficiency of the motor.

[**0154**] An optional outer cylinder (not shown) encompassing the ring layers **413** may assist in directing the ATP-containing liquid to the appropriate location. The outer cylinder may optionally include perforations for introducing the ATPcontaining liquid into the cylinder's interior. Alternatively, the ATP-containing liquid could be introduced via openings (not shown) provided in the central support rod **426**. The planar surfaces **414, 415** of the rings **410** may be provided with grooves as described in connection with **FIG. 12B** to facilitate the flow of the ATP-containing liquid. The outermost peripheral rings **410** could be affixed to the outer cylinder and, thus, the outer cylinder could be coupled to a drive member (not shown) in a manner similar to that shown in **FIG. 1**.

[**0155**] **FIG. 11** illustrates another molecular motor **330** embodiment that includes interdigitated discs. A stationary hollow cylinder **336** is supported on a base **335** and defines an internal void **339** that receives a drive shaft **333**. A mounting element **337** is received within a cavity **338** defined in the base **335**. The mounting element **337** rotatably secures the drive shaft **333** to the base **335**. A drive member **334** is coupled to the drive shaft **333** in any suitable manner. The drive member **334** may define gear teeth, support a drive belt, or be configured in any similar manner to provide useful work.

[**0156**] At least one outer disc **332** is mounted onto the inner surface of the stationary cylinder **336**. Planar surfaces **340** of the outer disc(s) **332** may be coated with myosin or, alternatively, actin. The outer disc(s) **332** defines a central orifice receiving the drive shaft **333**. The central orifice is designed to allow the drive shaft **333** to rotate freely relative to the stationary outer disc(s) **332**. For example, the circumference of the central orifice may be sufficiently greater than the circumference of the drive shaft **333** so that no contact can occur or, alternatively, bushings, ball bearings or similar devices may be located at the orifice edge/drive shaft edge interface.

[**0157**] At least one inner disc **331** is also disposed in the void **339**. Planar surfaces **341** of the inner disc(s) **331** may be coated with actin or, alternatively, myosin. If the surfaces **341** of the inner disc(s) are coated with actin, then the surfaces **340** of the outer disc(s) **332** should be coated with myosin. The inner disc(s) **331** and outer discs(s) **332** are arranged in an alternating pattern, and sufficiently close to each other, so that the actin and myosin can interact together in the presence of ATP. The inner disc **331** defines a central orifice as shown, for example, in **FIGS. 12A and 12B**. The drive shaft **333** is received in the central orifice and is affixed to the inner disc **331** at the edges of the central orifice.

[**0158**] During operation, a liquid containing a sufficient concentration of ATP is introduced between the respective planar surfaces of the discs. The actin and myosin interact with each other as described above. Movement of the actin layer attached to the inner disc(s) **331** results in rotation of the drive shaft **333** and drive member **334** relative to the stationary cylinder **336** and stationary outer disc(s) **332**.

[**0159**] A variant (not shown) of the motor **330** illustrated in **FIG. 11** could include an outer cylinder and attached outer disc(s) that could rotate relative to a stationary inner support rod and attached inner disc(s). The rotatable outer cylinder would be coupled to the drive member.

[**0160**] Variants of the above-described cylinder or cone embodiments are shown in **FIGS. 14 and 15**. In each of these variants, at least one continuous loop of a flexible substrate follows an elongated cylindrical, oblong, elliptical, serpentine or similar multiple turning radii rotation path. The flexible substrate can be, for example, a tape or thread, made from a compliant material such as a fibrous material. The continuous loop is supported by, and/or the rotation path is directed by, at least two rotation loci members such as another nested continuous loop (that, in turn, includes at least two rotation loci), cylinders or stanchions. One of the rotation loci members defines a surface that drives the continuous loop as detailed below. The rotation loci members are located at internal and/or external turning radii defined by the continuous loop.

[**0161**] With reference to **FIG. 14, a** molecular motor **440** is shown that includes a first cylinder **445** and a second cylinder **444** disposed, respectively, within a first internal radius **453** and a second internal radius **454** defined by a first flexible loop substrate **441**. The first flexible loop substrate **441** defines an inner surface **448** and an outer surface **449**. The inner surface **448** is in contact with, and supported by,