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(54) Wheel assembly for in-line roller skates

(57) In an in-line roller skate, a wheel bearing assembly (136) comprises an axle (240), a bearing spacer (220) axially disposed about the axle, and a pair of wheel bearings (230) axially coupled to and spaced apart by the bearing spacer (220). A magnet carrying sleeve (200) is juxtaposed between the wheel bearings (230) and concentric with the axle (240). At least one magnet (210) is disposed in the body portion (204) of the sleeve (200), and alternatively includes a second magnet disposed in diametric opposition relative to the first magnet. Alternatively, the second "magnet" is a similarly weighted non-magnetic element.

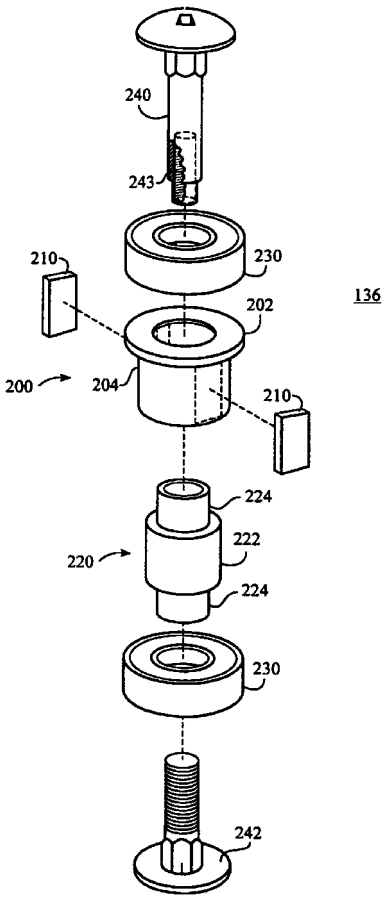

Fig. 2

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention pertains to the field of roller skates, and in particular to a wheel assembly having a magnetic mount for use with in-line roller skates.

BACKGROUND ART

[0002] Skating on in-line roller skates has become a very popular activity. One of the primary interests of in-line skaters is how fast they are traveling and how far they have gone. To provide this information, in-line skate speedometer and odometer systems have been developed. There are two fundamental types of these systems: wired and wireless. In a wired speedometer/odometer system, the speedometer display device is mounted directly to the skate by a mechanical fastener. In a wireless version, the speedometer display is mounted elsewhere on the user, and receives a wireless signal from a transmitter which is mounted to the skate by a mechanical fastener. In either configuration, the speedometer must detect and process the wheel rotation of the in-line skate to determine speed and distance. Detection is performed by sensing the presence of or changing strength of a magnetic field produced by a permanent magnet mounted to the wheel. The method by which this permanent magnet is mounted to the wheel can greatly affect the magnetic sensor's ability to detect the magnet and is directly related to the reliability and ease of use of the end product.

[0003] Fig. 6 shows the construction of a typical wheel assembly 130 used in an in-line roller skate. The wheel assembly comprises a rubber portion (tire) 132 and a hub 134 received in the tire. Wheel bearings 230, spaced apart by a bearing spacer 220, are inserted into hub 134. Finally, an axle 240 and axle nut 242 are received through bearing spacer 220 to complete the wheel assembly.

[0004] Many approaches and methods have been used to mount a permanent magnet to the wheel of an in-line skate. Magnets have been adhered to the side of the wheel with glue or double-sided tape. However, due to the small distance between the wheel and the wheel frame on which the wheels are mounted the magnets must be very small. In addition, magnets mounted on the outside of the wheel are fully exposed to the elements which is likely to weaken the integrity of the adhesive agent holding the magnet in place on the wheel, or otherwise subject the magnet to physical contact which can knock it off the wheel.

[0005] In another approach, the magnet is pressed within the spokes of the hub of the wheel. The size and shape of the magnet must be carefully selected to fit the limited space within the hub. Hub designs, however, are usually in a constant state of change. Consequently, it is not possible to provide a magnet which would successfully mate with an acceptable percentage of wheel hubs. In some cases, the specific hub design may only allow for a magnet so small as to be insufficiently detectable by the detection electronics.

[0006] In yet another approach, the magnet is inserted into a blind hole drilled through the rubber portion of the wheel. For example, German utility Patent No. DE 297 08 535 U1 shows in Figs. 2 and 3 a magnetic element 32 inserted within wheels. This approach requires both skill and equipment on behalf of the user in order to insert the magnet without damaging the wheel. In addition, the drilling procedure must be performed each time the wheel is replaced. This approach is labor intensive and far from being user friendly.

[0007] What is needed is a magnet mounting scheme that is reliable and resistant to the harsh environments to which an in-line skate is typically exposed. It is desirous that the magnet mounting scheme be adaptable to the numerous wheel designs which exist and to future designs yet to be made. It is further desirable that the magnet mounting scheme be easy to use.

SUMMARY OF THE INVENTION

[0008] In accordance with the invention, an in-line roller skate comprises a skate boot and a wheel frame coupled to the skate boot. The wheel frame includes a plurality of wheels rotatably mounted thereto. At least one wheel assembly includes a bearing assembly comprising an axle member and a magnetic carrier. A pair of wheel bearings flank each side of the magnetic carrier and rotates in unison with the bearings. The magnetic carrier includes a magnet disposed in the body of the carrier. A bearing spacer is axially disposed along the axle member and spaces the axle member apart from the magnetic carrier and the wheel bearings.

[0009] In a preferred embodiment of the invention, a single magnet is used. However, in an alternate embodiment, a second magnet is disposed in diametric opposition relative to the first magnet. The second magnet serves to offset the imbalance of the first magnet. Also in the preferred embodiment of the invention, the in-line skate further comprises detection electronics for detecting presence or change in strength of the magnetic field during skating.

[0010] The advantage of the invention lies in the fact that key elements of a wheel assembly are fairly uniform in size and shape, such as the wheel hub bearing shoulder, wheel bearings, wheel hub through hole and bearing spacer. They provide a purely utilitarian function and thus are not expected to change over time. This allows for a few standard magnetic carriers to be produced which would suffice for all wheel assemblies. Moreover, wheel assemblies for in-line skates are designed to be dis-assembled by the user for bearing or wheel replacement. It is therefore a trivial matter to insert the magnetic carrier when the wheel assembly is re-assembled.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

Fig. 1 shows an in-line roller skate in accordance with the present invention.

Fig. 2 is an exploded view of a bearing assembly in accordance with the present invention.

Fig. 3 is an exploded view of a wheel assembly in accordance with the present invention.

Fig. 4 is a sectional view of a wheel shown in Fig. 1 taken along view line 4-4.

Fig. 5 is a perspective view of the magnetic carrier of the present invention.

Fig. 6 is an exploded view of a prior art wheel assembly.

BEST MODE FOR CARRYING OUT THE INVENTION

[0012] As shown in Fig. 1, an in-line skate 100 comprises a skate boot 110 having a bottom portion 112. A wheel frame 120 is coupled to bottom portion 112 of the skate. A plurality of wheels 130 is coupled to wheel frame 120 in collinear fashion.

[0013] With reference to Figs. 1 - 3, each wheel assembly 130 comprises a rubber portion (tire) 132 and a concentrically disposed hub 134. Hub 134 is supported on a bearing assembly 136 to provide rotation of the wheel. Bearing assembly 136 comprises an axle 240 and a pair of wheel bearings 230 spaced apart from each other and from axle 240 by a bearing spacer 220. Axle 240 is kept in place by threading an axle bolt 242 into a threaded cavity 243 of the axle. In accordance with the preferred embodiment of the invention, at least one of the bearing assemblies includes a magnet carrying sleeve 200 juxtaposed between and axially aligned with its wheel bearings 230.

[0014] As shown in Figs. 2 and 5, magnet carrying sleeve 200 comprises a cylindrical body portion 204 and a flange 202. Axle 240 is axially received through body portion 204. Flange 202 has an outside diameter substantially equal to the diameter of wheel bearing 230. Sleeve 200 includes a magnetic element 210 disposed in body portion 204. Preferably, sleeve 200 includes only one magnet, but may include two magnets 210A and 210B disposed at diametrically opposite positions on body portion 204 as can be seen in Fig. 5. This arrangement of the magnets ensures that the wheel is balanced when rotating, although it has been observed that the imbalance forces of the single-magnet configuration are insignificant. Alternatively, the second "magnet" 210B can simply be a similarly weighted non-magnetic element. While not shown in the figures, it is also within the scope of the invention to have more than two equally spaced apart magnets circumferentially disposed in body portion 204 of the sleeve.

[0015] The cross-sectional view of Fig. 4 shows the assembly of the wheel components in accordance with the present invention. The bore of hub 134 includes a shoulder 420 against which wheel bearing 230B is pressed. Flange 202 of magnetic carrier sleeve 200 is held in position by being similarly pressed between shoulder 420 and wheel bearing 230A. The opening of hub 134 has a diameter D that is sufficient to provide a friction fit of wheel bearings 230. This arrangement effectively immobilizes sleeve 200 and wheel bearings 230 relative to hub 134 and rubber portion 132 of wheel assembly 130. A central body portion 222 of bearing spacer 220 is dimensioned in length to span the separation distance between wheel bearings 230A and 230B, including the thickness of flange 202 of sleeve 200.

[0016] An important aspect of the invention is that magnet-carrying sleeve 200 be maintained stationary relative to hub 134 when the wheel is rotating. Thus, sleeve 200 may be configured such that it is held in position within the hub bore by its own interference fit. For example, sleeve 200 may comprise a tubular portion, absent the flange and having a longitudinal cut through the tubular portion. The result is a spring-like sleeve having a C-shaped cross-section. The spring-like member will compress upon insertion into a smaller diameter hub bore. The restoring force of the spring-like member will press against the interior wall of the hub bore thus creating an interference fit. Thus by dimensioning sleeve 200 with an appropriate outside diameter, a variety of hub bore diameters can be accommodated. Another approach to achieving a friction fit within the hub bore is to provide nibs (e.g. nibs 410 in Fig. 5) or spring-like protrusions upon the outer surface of sleeve 200. These and other configurations of sleeve 200 are contemplated by this invention and deemed to be within the skill of a person of ordinary skill in the art.

[0017] With respect to Fig. 5, magnetic carrying sleeve 200 is preferably formed of a self-lubricating plastic compound such as an acetal compound. Magnets 210A and 210B (or a single magnet) are placed in a mold and molten plastic is injected into the mold thus forming sleeve 200 and embedding the magnet(s) in place.

[0018] Returning to Fig. 1, bottom portion 112 of skate boot 110 includes detection electronics 114 disposed proximate wheel 130. In the preferred embodiment of the invention, detection electronics 114 is constructed in accordance with the circuitry disclosed in U.S. Patent No. 5,721,539 and assigned to the assignee of the present invention, and is herein incorporated by reference.

[0019] In operation, as wheel 130 rotates during skating, magnetic carrier sleeve 200 rotates in unison. Recall that sleeve 200 is held in fixed relation to hub 134 by virtue of flange 202 being clamped between the hub and wheel bearing 230. As can be seen in Fig. 1, detection electronics 114 is disposed proximate a wheel fitted with magnet carrying sleeve 200. Thus, as the sleeve rotates, magnet 210 passes near to detection electron-

ics 114 and the field emanating from the magnet is detected as a magnetic pulse. Based on the rate at which the pulses are detected, a speed calculation is made and the result displayed to the skater. In the embodiment where sleeve 200 comprises two or more equally spaced apart magnets disposed therein, the pulses will occur at a higher rate. Detection electronics 114 can be readily adapted to compute the correct speed based on the increased rate of detected pulses.

Claims

1. In an in-line skate having a plurality of collinearly mounted wheels, each wheel having a bearing assembly, at least one of said bearing assemblies comprising:

an axle;
a magnetic carrier having at least one region from which a magnetic field emanates, said magnetic carrier being stationary relative to the wheel corresponding to said one of said bearing assemblies;
first and second wheel bearings, each wheel bearing disposed about said axle.

2. The in-line skate of claim 1 further including a bearing spacer axially disposed about said axle, said magnetic carrier being disposed about said bearing spacer.

3. The in-line skate of claim 2 wherein said magnetic carrier is a sleeve disposed about said bearing spacer.

4. The in-line skate of claim 1 wherein said at least one region includes a first magnetic element.

5. The in-line skate of claim 4 wherein said magnetic carrier further includes a second magnetic element.

6. The in-line skate of claim 5 wherein said second magnetic element is diametrically opposed with respect to said first magnetic element.

7. The in-line skate of claim 4 wherein said magnetic carrier further includes a non-magnetic element, said non-magnetic element being of substantially equal weight to said first magnetic element.

8. The in-line skate of claim 7 wherein said non-magnetic element is diametrically opposed said first magnetic element.

9. In an in-line skate having a skate boot, a wheel frame coupled to a bottom of said skate boot, and a plurality of wheels rotatably mounted to said wheel frame, at least one wheel comprising:

a rubber portion having a hub; and a spindle assembly;
said spindle assembly including:
an axle;
a magnetic carrier having a magnetic portion and means for maintaining a fixed position relative to said hub;
a first wheel bearing concentrically disposed about said axle at a first axial end of said axle; and
a second wheel bearing concentrically disposed about said axle at a second axial end of said axle.

10. The wheel of claim 9 wherein said magnetic portion is a permanent magnet disposed in the body of said magnetic carrier.

11. The wheel of claim 10 wherein said magnetic carrier further includes a second permanent magnet disposed in the body of said magnetic carrier.

12. The wheel of claim 10 wherein said magnetic carrier further includes a non-magnetic member disposed in the body of said magnetic carrier, said non-magnetic member having substantially the same weight as said permanent magnet.

13. The wheel of claim 9 wherein said spindle assembly further includes a bearing spacer axially disposed about said axle, said magnetic carrier and said wheel bearings being disposed about said bearing spacer.

14. The wheel of claim 9 wherein said magnetic carrier is a sleeve having first and second ends, said means for maintaining being a flange disposed at said first end of said sleeve, said wheel bearings and said flange frictionally engaged with said hub so that said magnetic carrier rotates in unison with said rubber portion.

15. An in-line skate comprising:

a skate boot having a bottom portion; and
a wheel frame coupled to said bottom portion, said wheel frame having a plurality of wheels rotatably mounted thereto;
each of said wheels including a tire having a concentrically disposed hub, and a bearing assembly axially received in said hub;
said bearing assemblies each having a pair of wheel bearings and an axle concentrically received in said wheel bearings;
at least one of said bearing assemblies further having a magnet carrying sleeve axially disposed about its axle and juxtaposed between its wheel bearings.

16. The in-line skate of claim 15 wherein said magnet carrying sleeve of said at least one of said bearing assemblies includes at least one magnet element disposed about said axle.

17. The in-line skate of claim 15 wherein said magnet carrying sleeve of said at least one of said bearing assemblies includes first and second magnet elements disposed in diametric opposition with respect to each other.

18. The in-line skate of claim 15 wherein said magnet carrying sleeve of said at least one of said bearing assemblies includes a magnetic element and a non-magnetic element disposed in diametric opposition with respect to each other.

19. The in-line skate of claim 15 further including a wireless transmitter circuit disposed with said skate boot and proximate said at least one of said bearing assemblies.

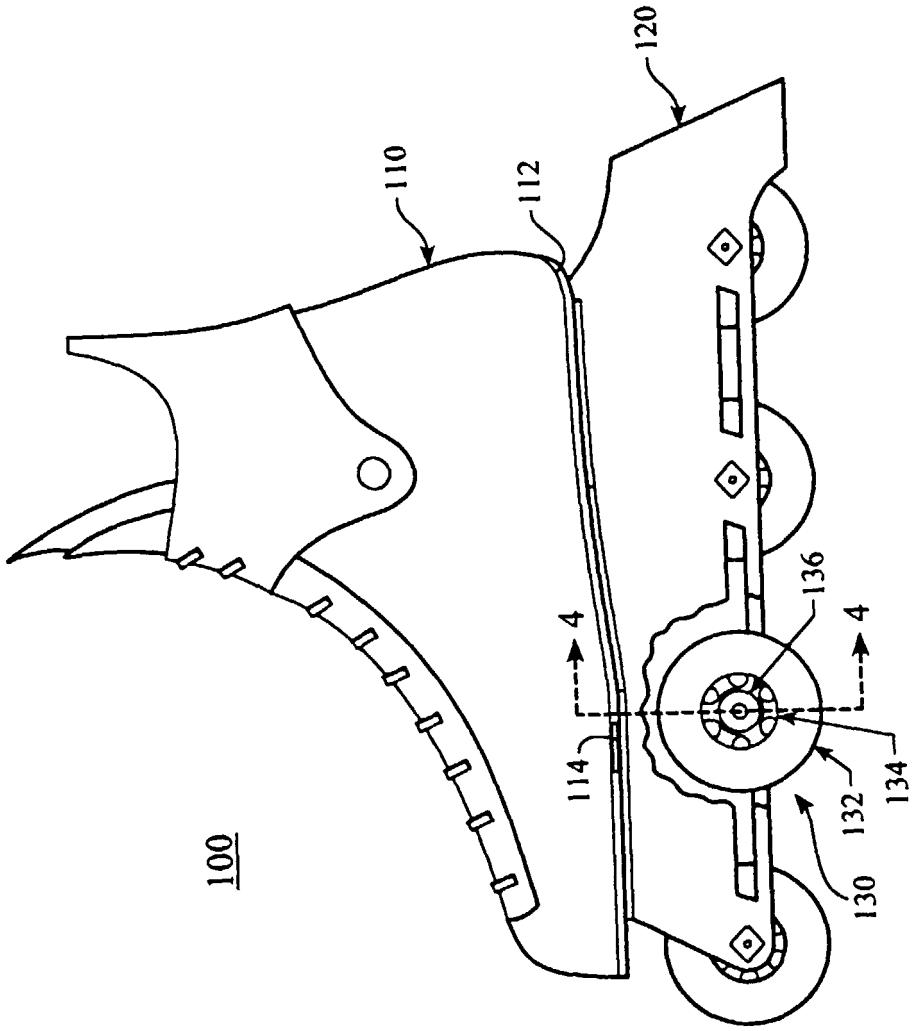

Fig. 1

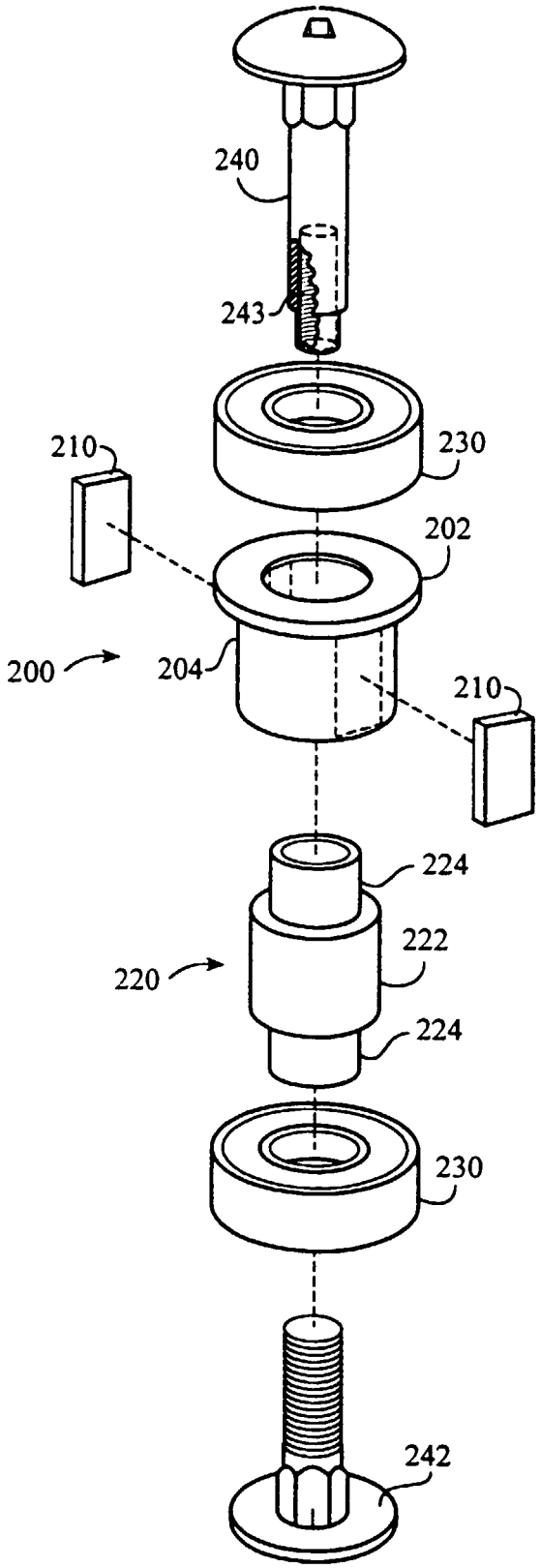

Fig. 2

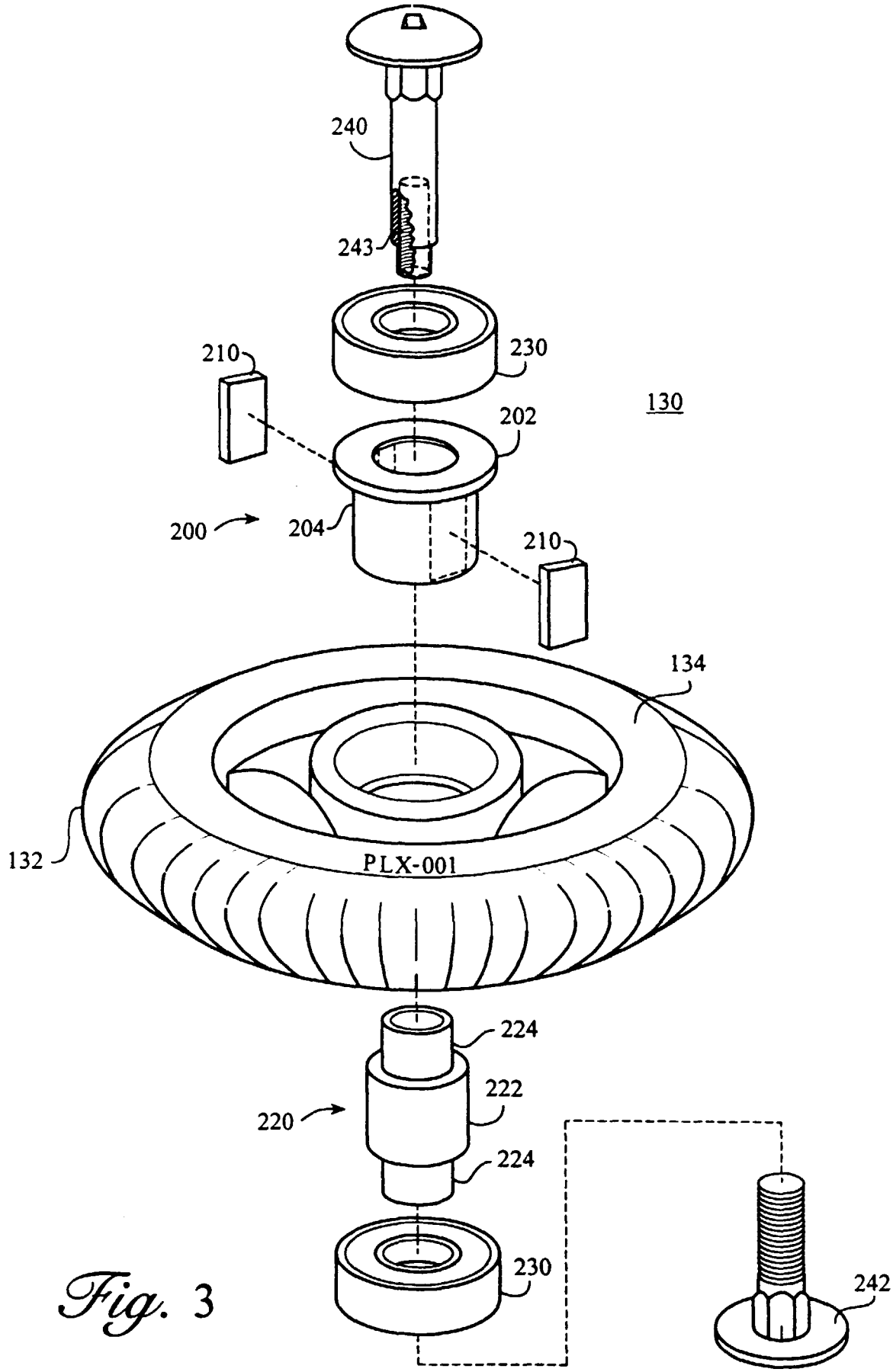
240
243
230
210
130
202
200
204
210
134
132
PLX-001
224
222
220
224
230
242

Fig. 3

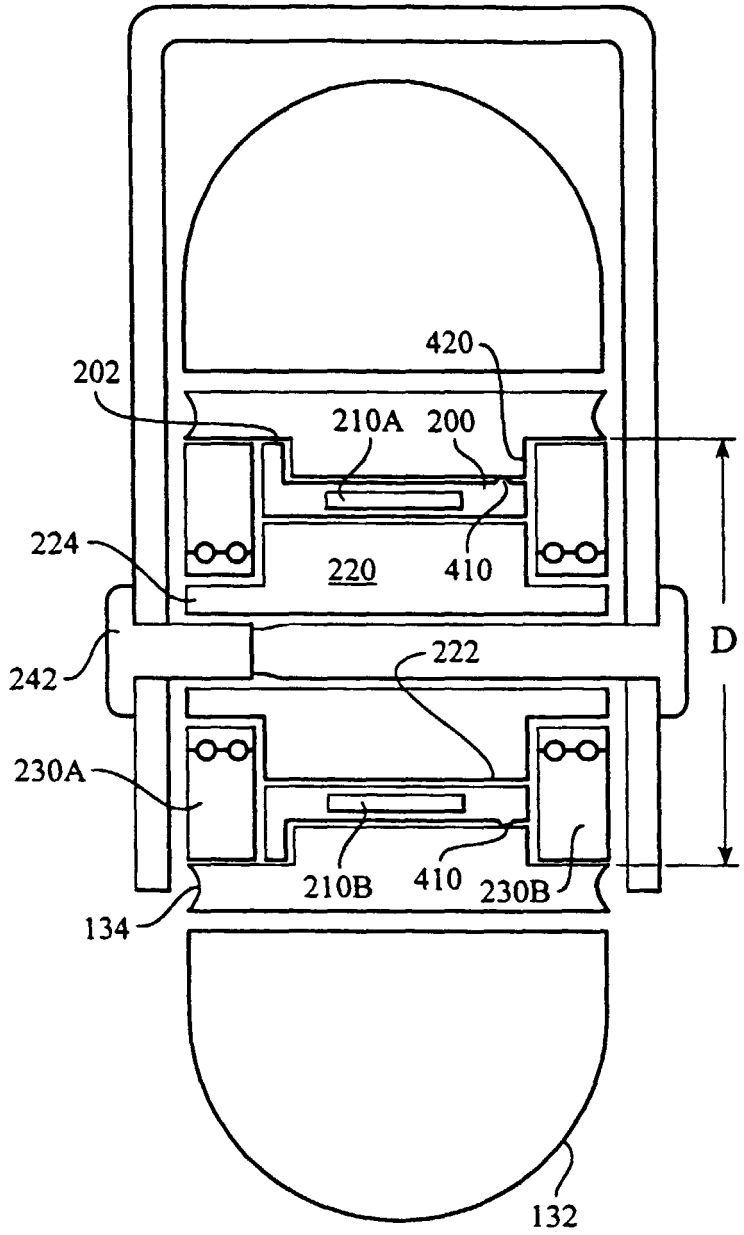
420
202
210A
200
224
220
410
D
242
222
230A
210B
410
230B
134
132

Fig. 4

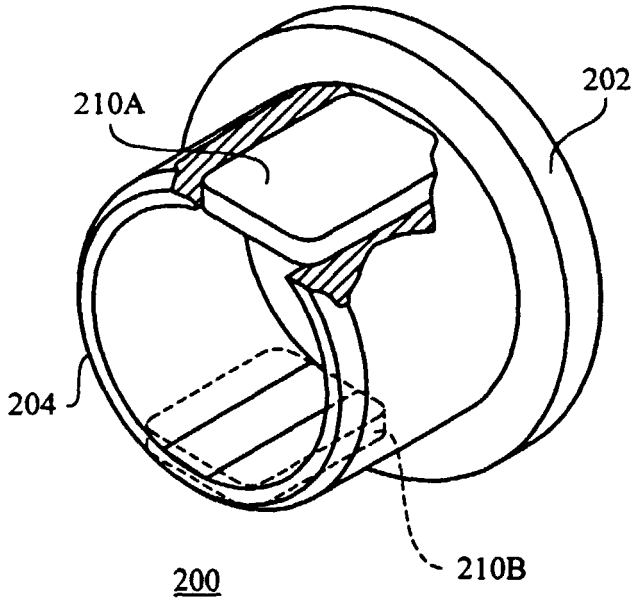
210A
202
204
210B
200

Fig. 5

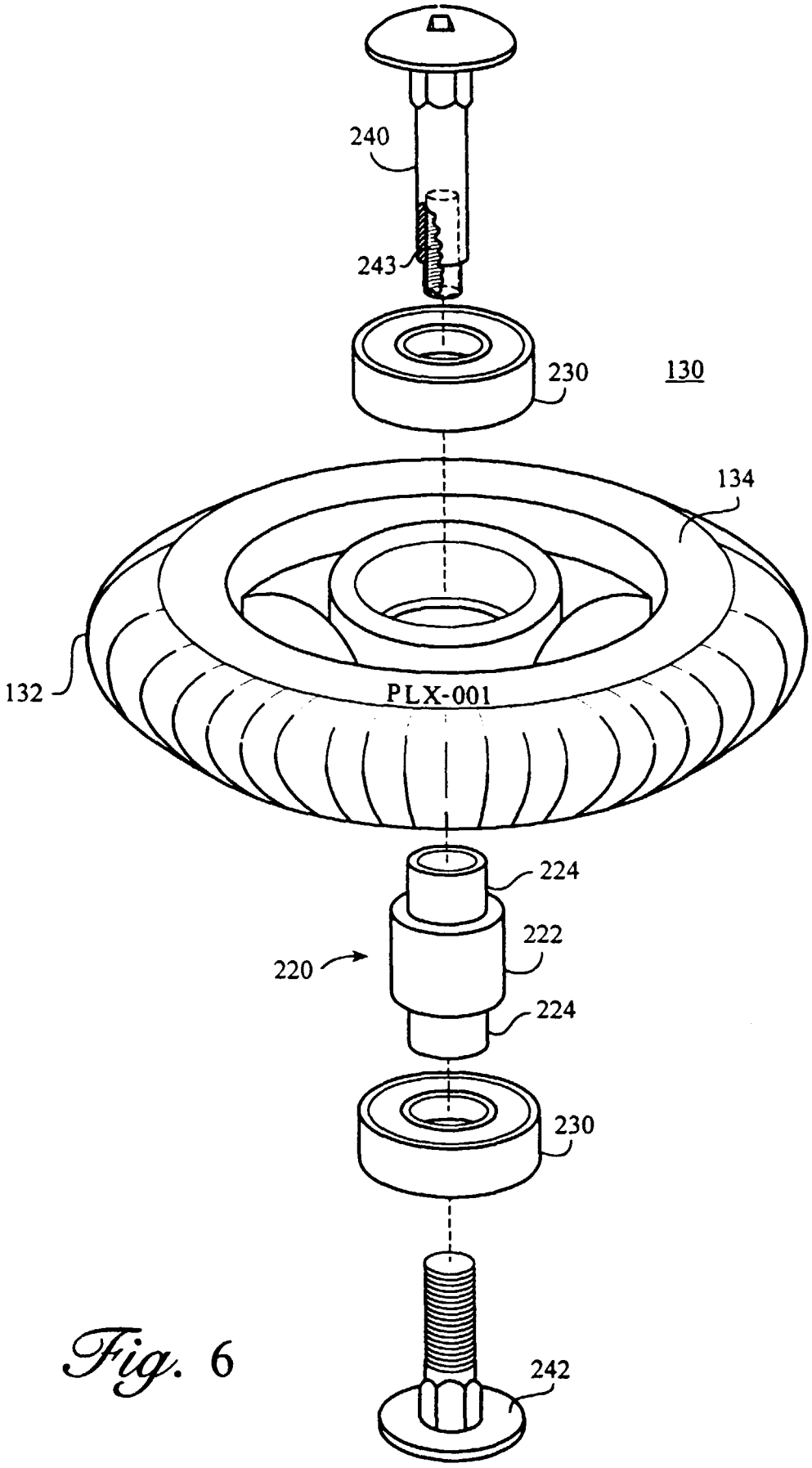

Fig. 6