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(54) **HIGH LOAD BEARING CENTRAL-BRAKING CASTER**

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(57) **ABSTRACT**

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A high-load, high-performance, twin-wheeled central-braking caster for a bed is provided having two wheels each comprised of an aluminum core disc and an annular cylindrical flange. The inside of the flanges are covered with elastomeric material in order to serve as brake drums for the wheels. The caster has a central braking mechanism comprising a spring-loaded double-armed brake lever mounted on a pivot pin to guide the brake lever so that it pivots exclusively about a horizontal axis perpendicular to the direction of the wheels' forward rolling movement. The central braking mechanism further comprises a pivot block with an aperture for receiving the pivot pin for mounting the brake lever. The braking mechanism further comprises two compression springs having sufficient spring force to bias the double-armed brake lever away from the wheel. Recesses are provided in the pivot block for anchoring an end of each of the compression springs, the opposite ends of the compression springs being disposed to provide a pushing force against a saddle portion of the double-armed brake lever in order to bias the brake arm away from the brake drum. Flattened teeth are provided on each arm of the brake lever to grab the elastomeric material on the inside surface of the corresponding wheel's annular flange in order to inhibit wheel rotation.

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(52) **U.S. Cl.** **16/35 R; 16/47**

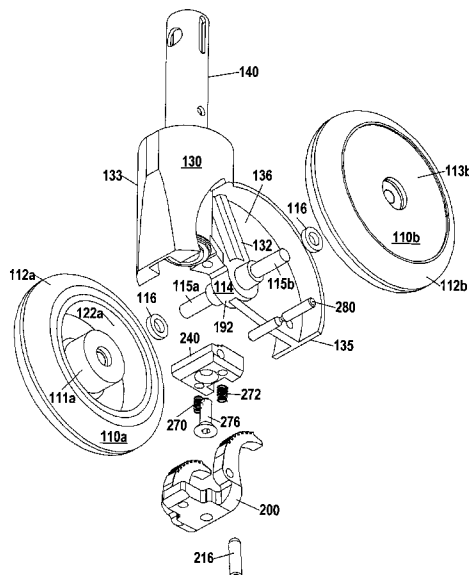
(58) **Field of Search** 16/35 R, 35 D, 16/38, 31 R, 31 A, 43, 47; 188/1.12, 29; 5/600, 625, 626, 618, 86.1

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21 Claims, 10 Drawing Sheets



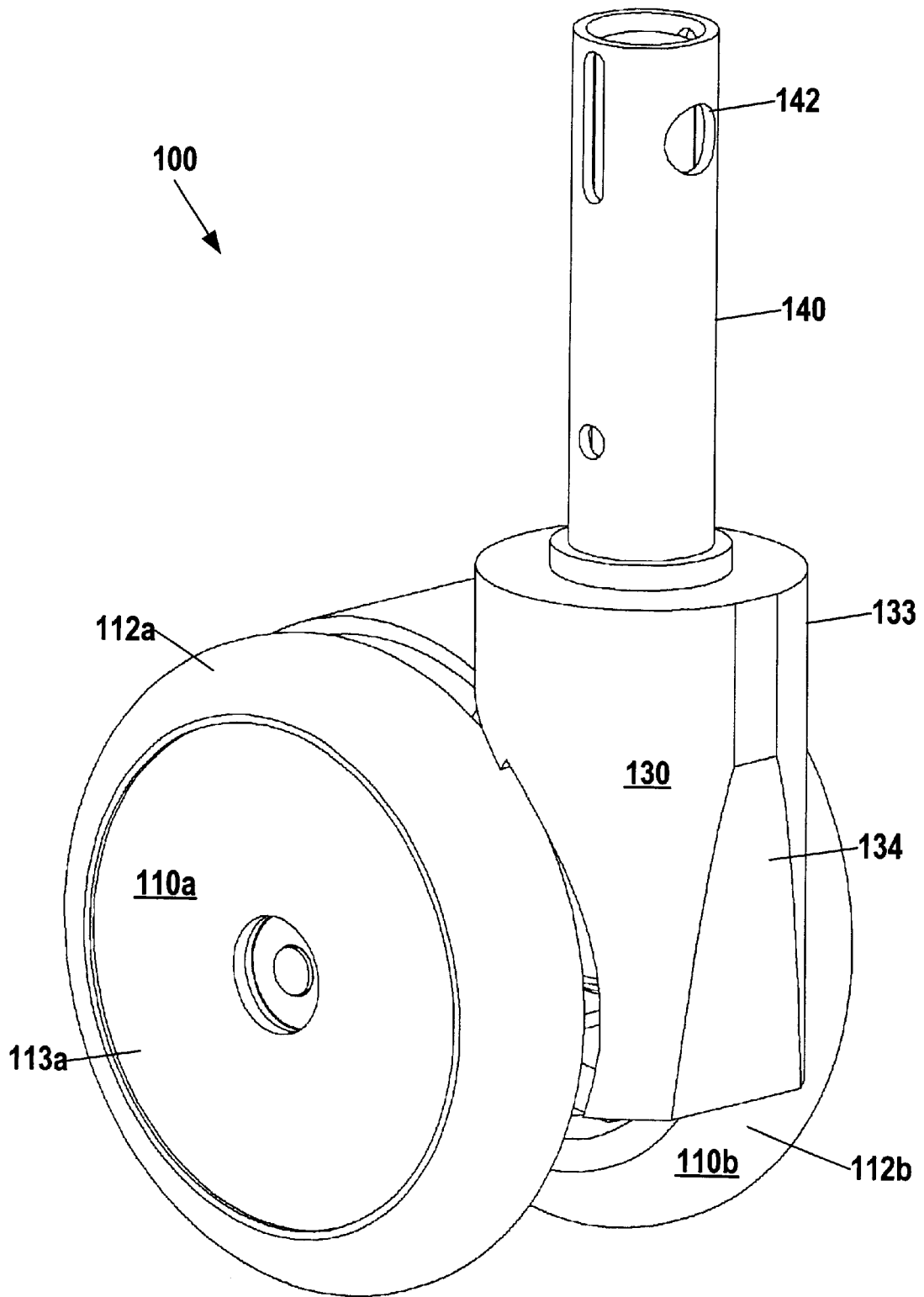


FIG. 1

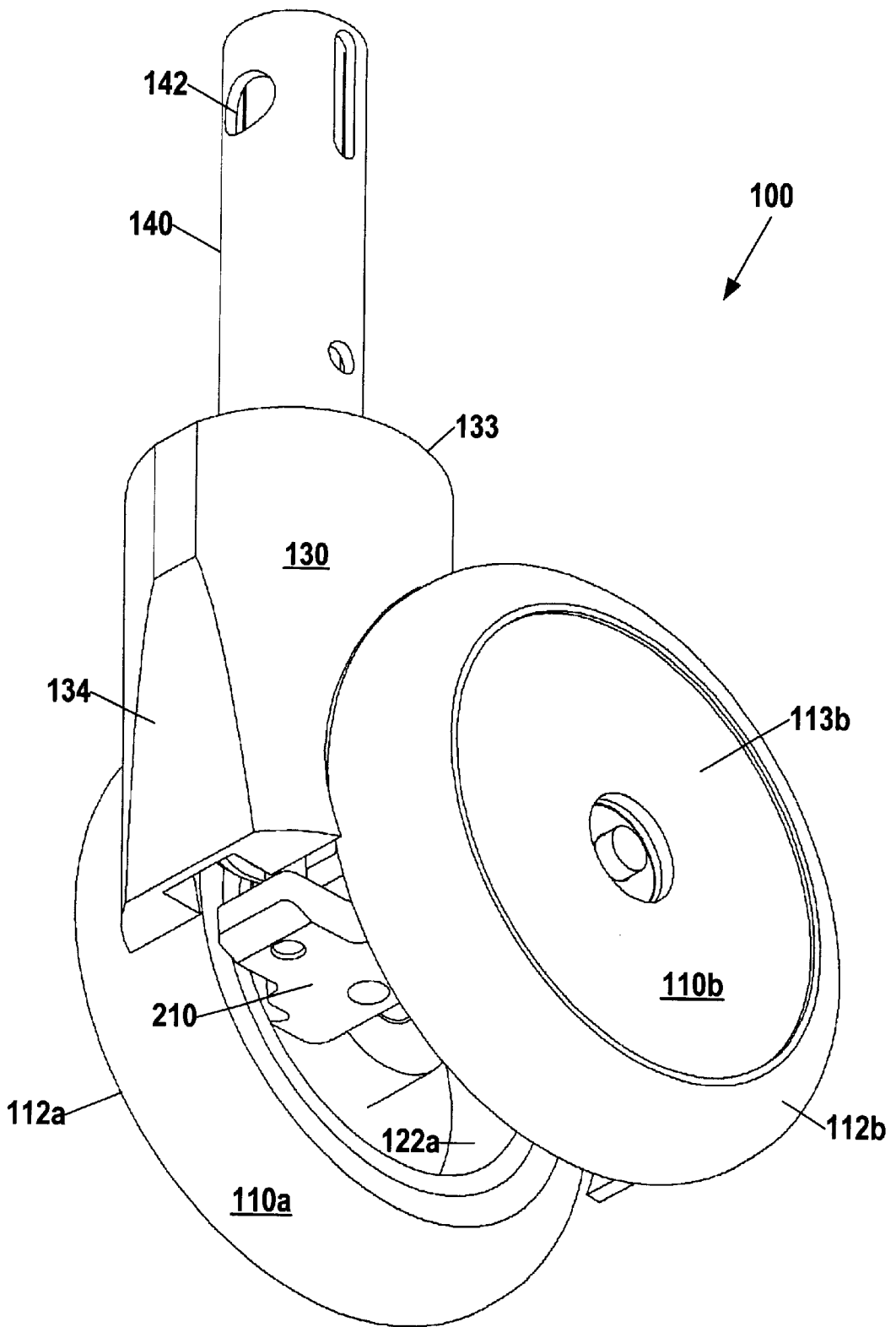


FIG. 2

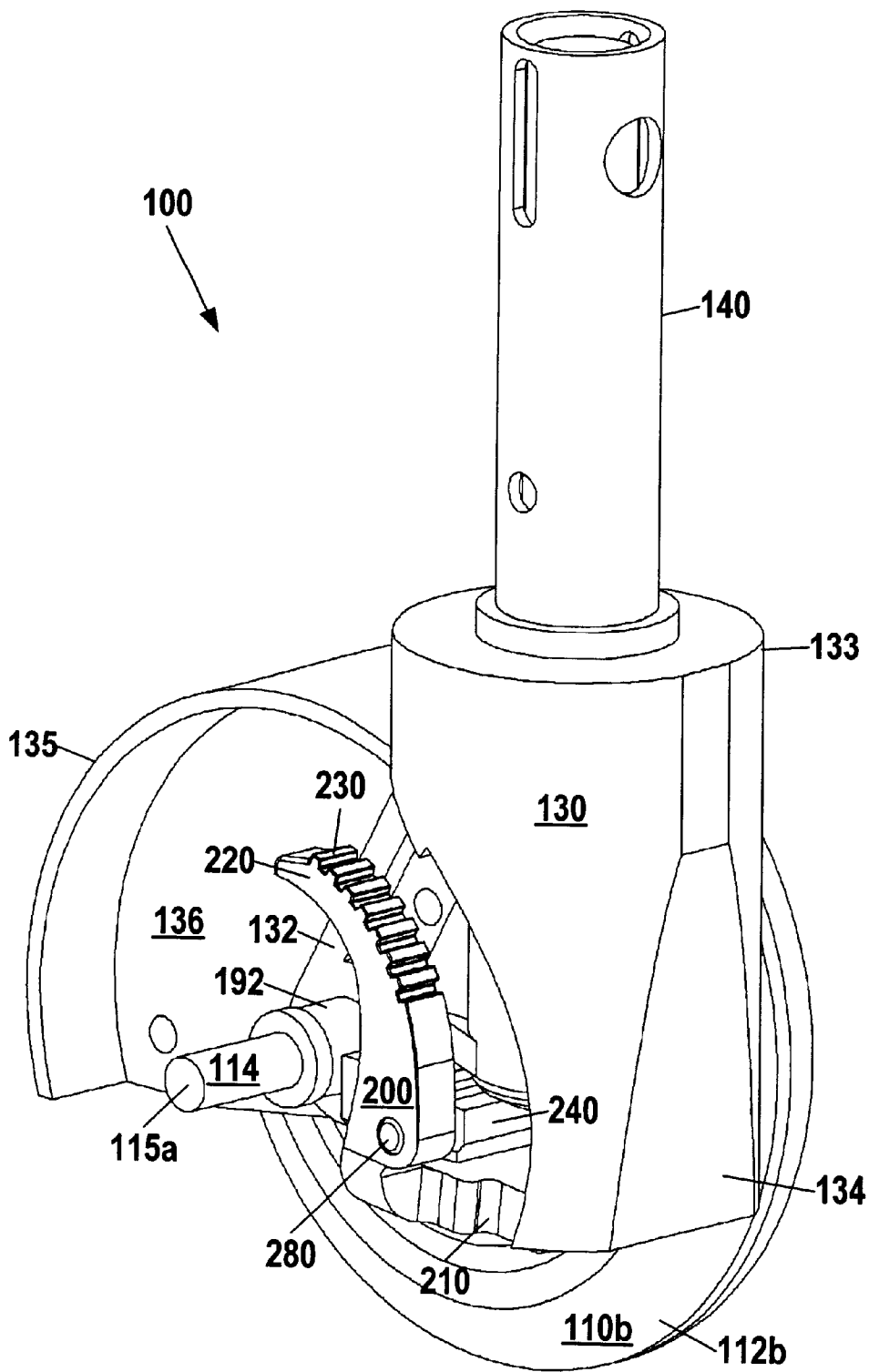


FIG. 3

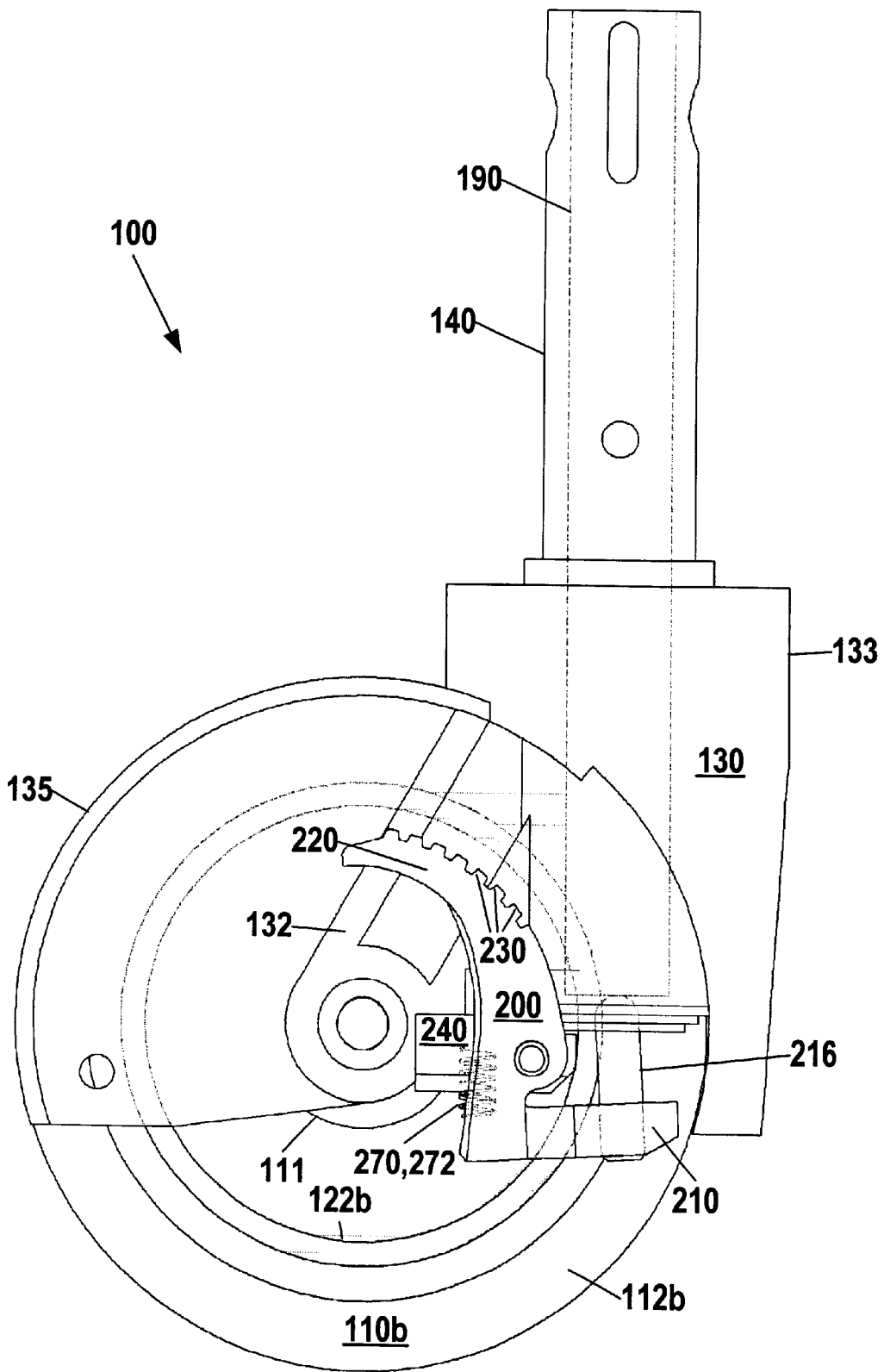


FIG. 4

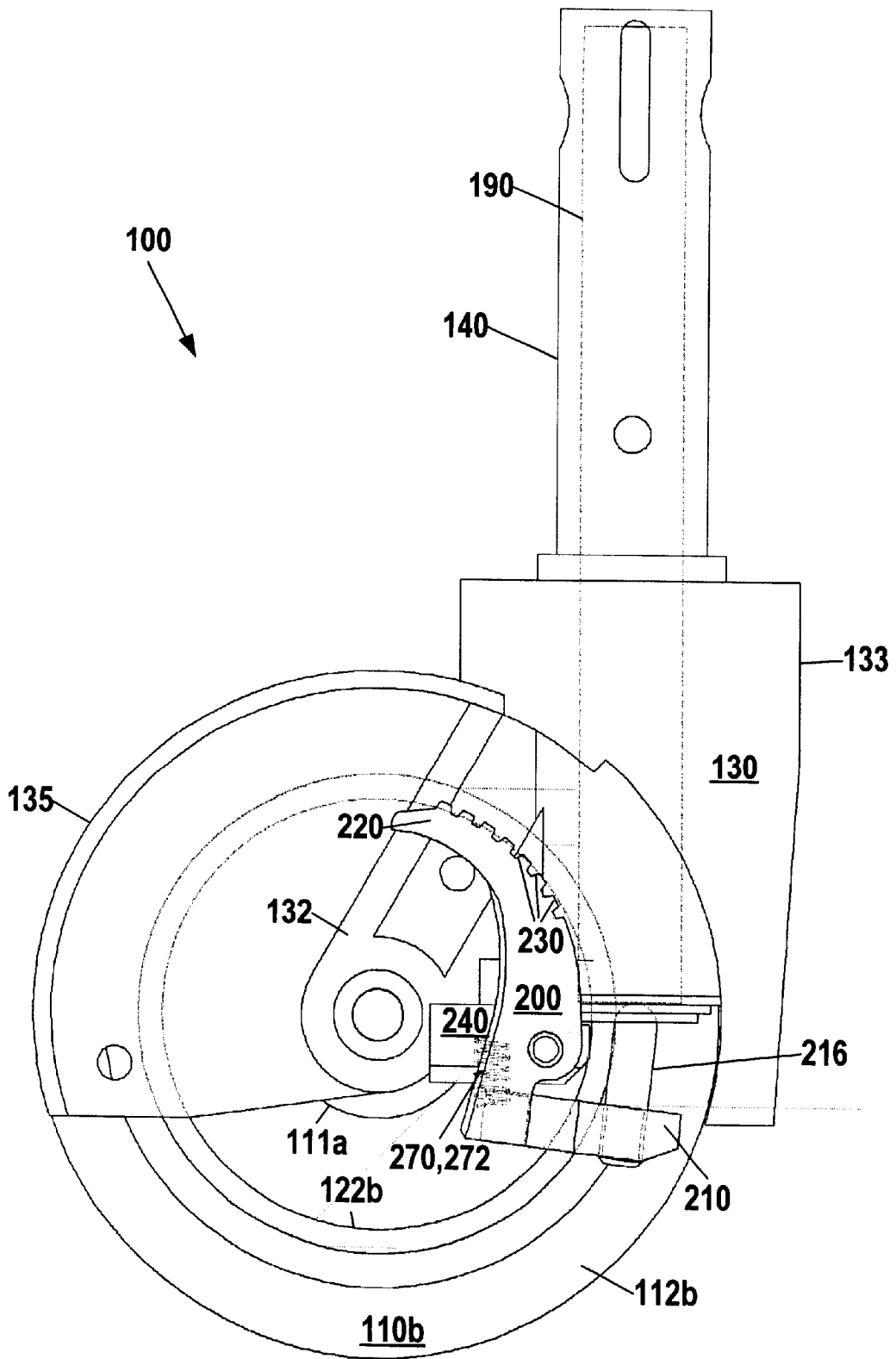


FIG. 5

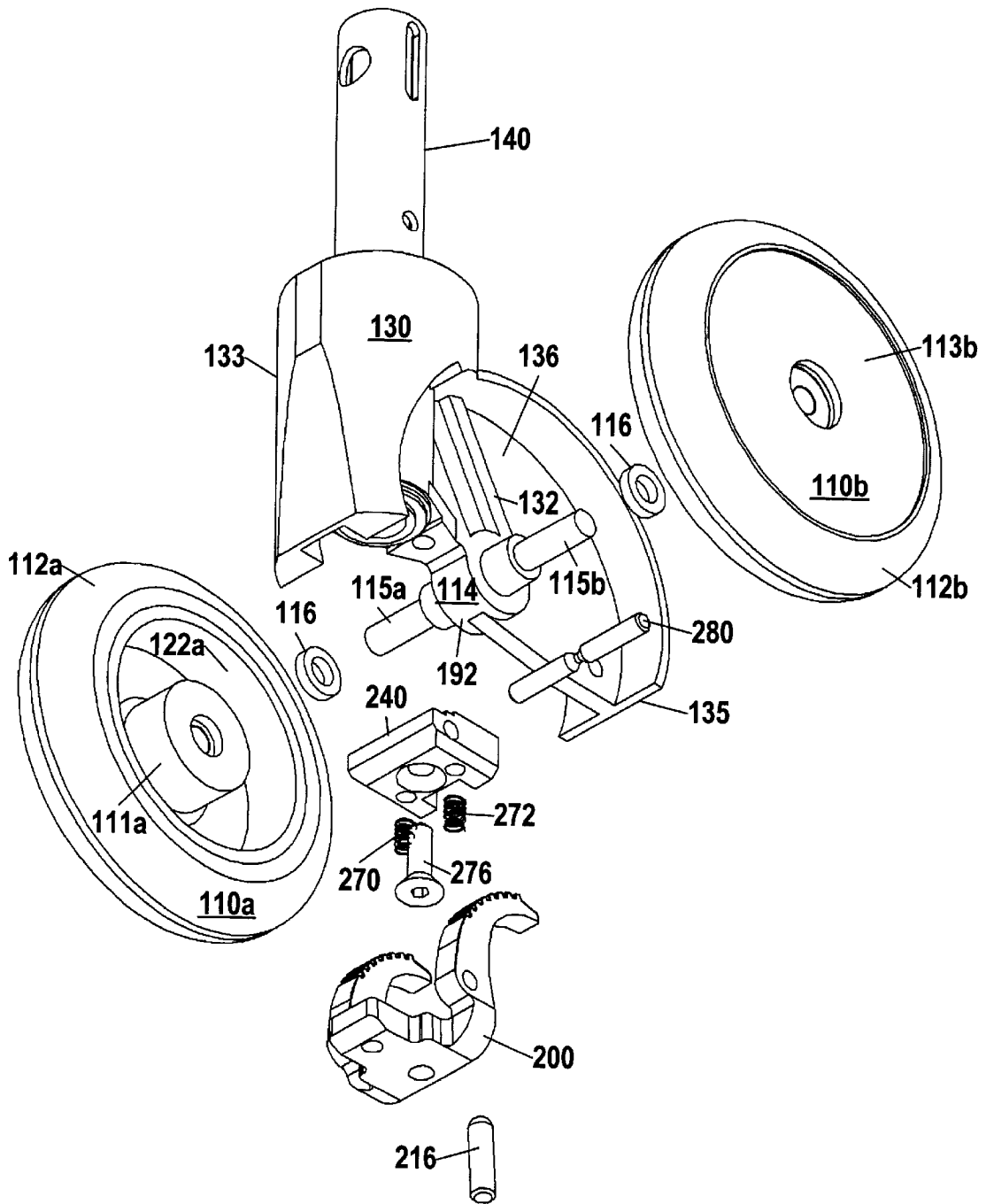


FIG. 6

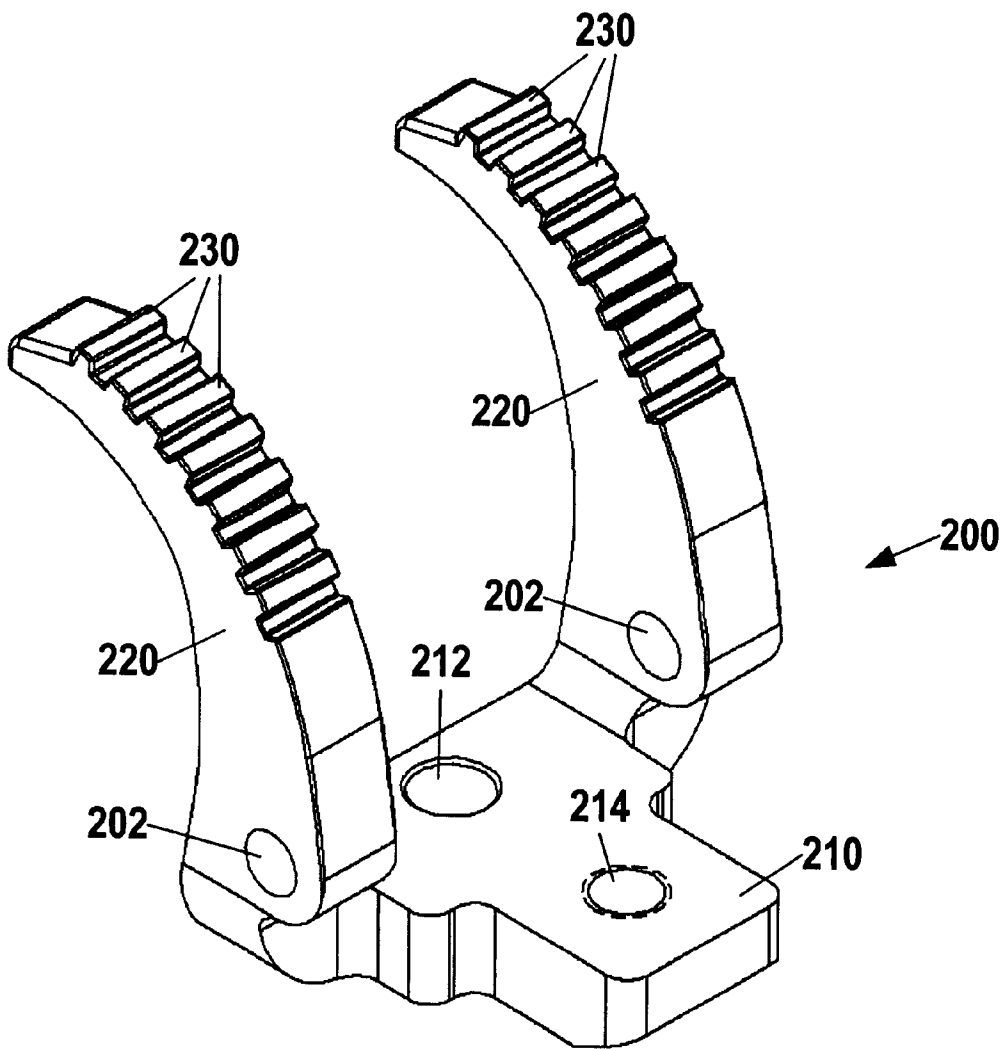


FIG. 7

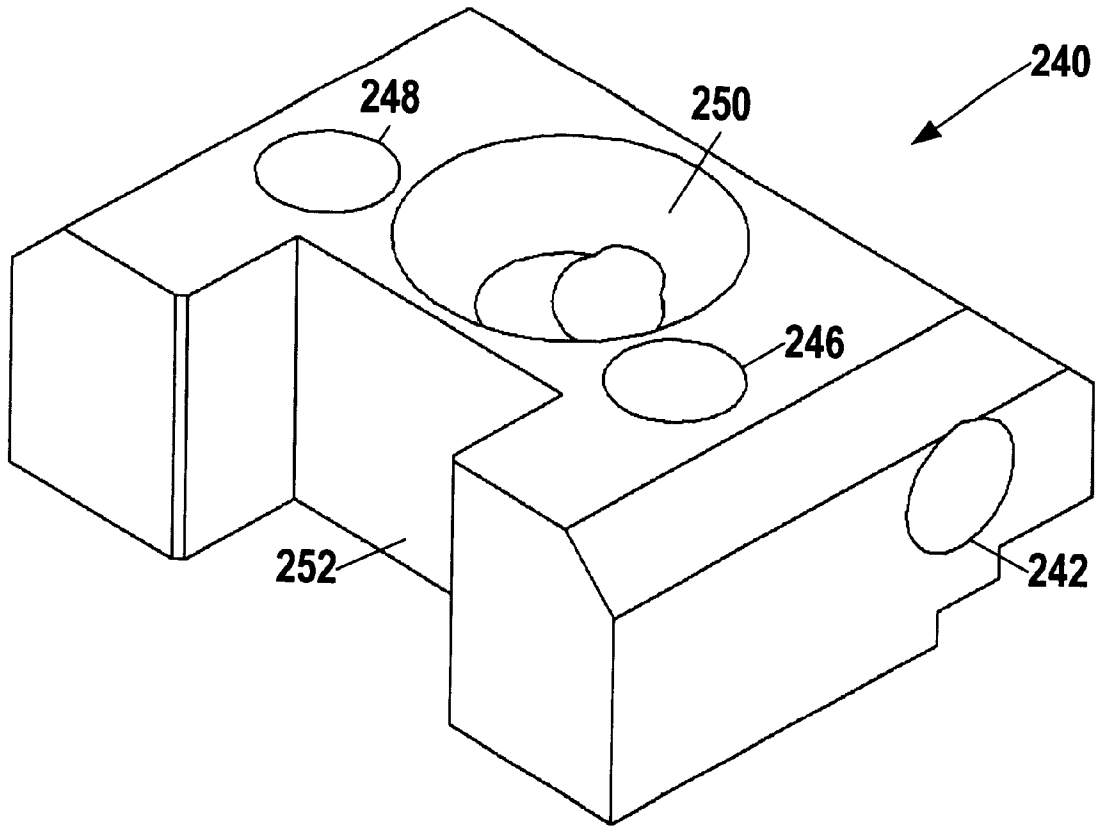


FIG. 8

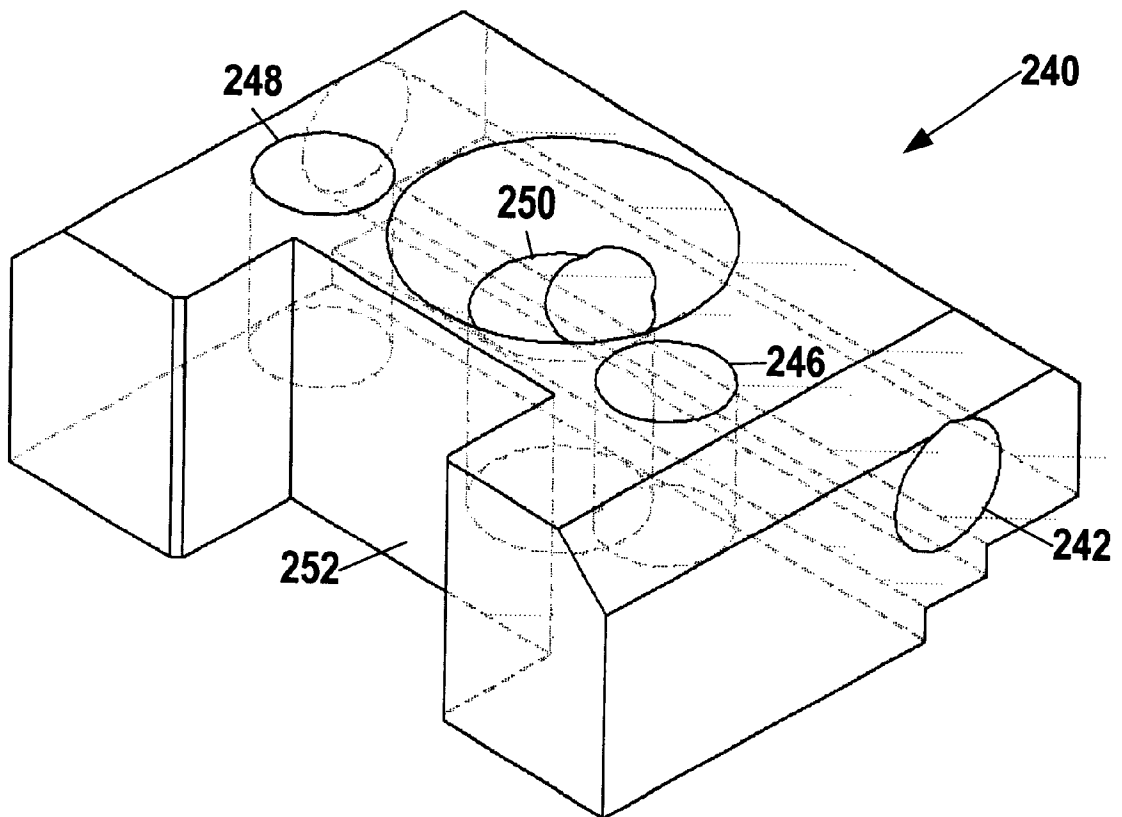


FIG. 9

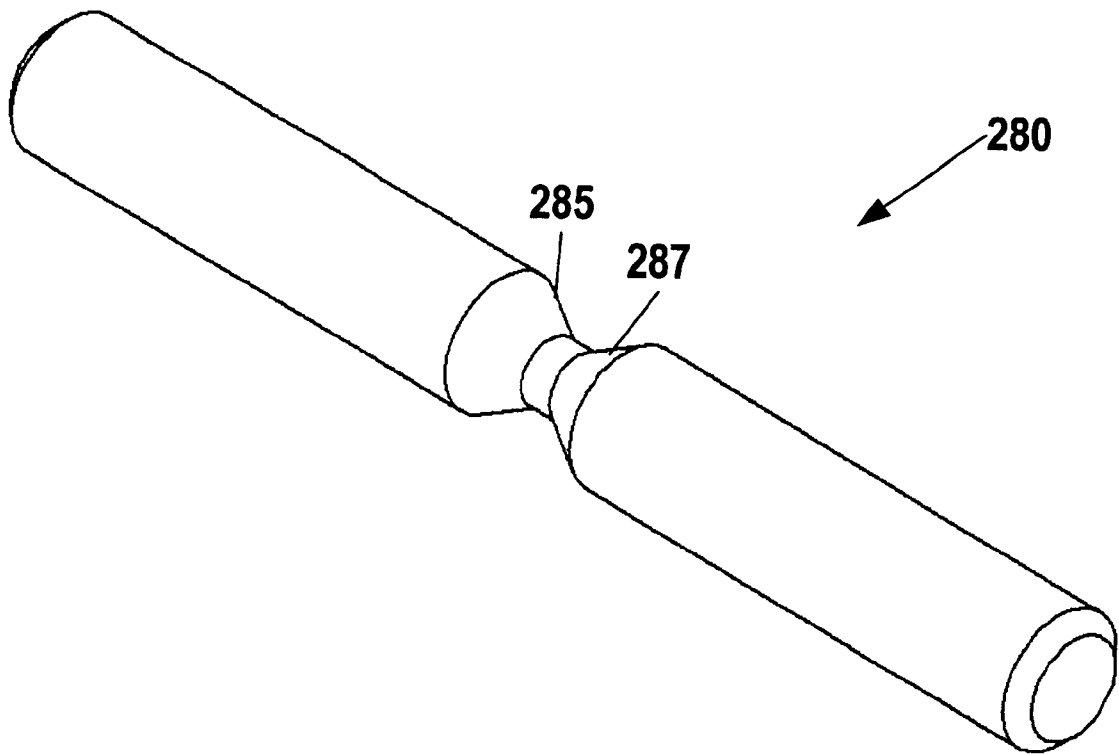


FIG. 10

**HIGH LOAD BEARING CENTRAL-BRAKING
CASTER**

FIELD OF THE INVENTION

This invention relates generally to a caster having a central locking device for arresting its wheel.

BACKGROUND

Traditional central locking casters comprise a wheel mounted on a fork, the fork having a sleeve that houses a plunger or push rod, and a mushroom-shaped breaking member mounted on the bottom of the plunger or push rod that engages the perimeter of the wheel in order to lock it. Examples and variations of such casters are disclosed in U.S. Pat. No. 3,911,525 to Haussels; U.S. Pat. No. 4,414,702 to Neumann; and U.S. Pat. No. 5,774,936 to Vetter.

A disadvantage of several traditional central locking casters is their yokes often fail prematurely under heavy loads. For especially heavy loads (such as with bariatric beds), double wheel casters typically perform better under heavy loads and in circumstances where maneuverability is critical. For obvious reasons, traditional central locking mechanisms are not as suitable for double-wheeled casters as they are for single-wheeled casters.

Many alternative braking mechanisms have been designed for casters. U.S. Pat. No. 3,914,821 to Screen, for example, discloses a foot-operated brake linked to a brake shoe that engages an inner surface of the roller. Another patent to the same inventor, U.S. Pat. No. 4,747,180, discloses a braking system for a caster comprising a cam-activated brake rod able to extend all the way to the floor to prevent movement. U.S. Pat. No. 5,014,391 to Schulte discloses a brake lever bearing a sharp-toothed brake member that interacts with a brake rim. U.S. Pat. No. 4,550,808 to Folson discloses a caster having a foot-operated brake lever that acts against a link, which in turn acts against a brake shoe comprising two side arms or flanges that "actually dig into" the inside surface of the outer cylindrical flange of the caster wheel. Darcor®, based in Toronto, Canada, markets a caster wheel designed in particular for bariatric beds that utilizes a push rod that acts upon a spring-loaded brake arm bearing sharp teeth to mate against an inner surface of the roller wheel.

Many problems have been encountered with existing teeth-based brake designs. The teeth can break off prematurely, destroying the caster's braking function. Moreover, the teeth prematurely wear out the braking surface of the wheel. Another problem encountered with one commercially popular brake-arm design is that the brake arm is loosely anchored in a manner that allows it to rock from side to side, instead of pivoting exclusively about a horizontal axis perpendicular to the direction of the wheel's forward rolling movement. The biasing spring force is also poor. Therefore, when the caster wheel is jarred, as occurs when rolling a bed over a bump, the sharp teeth of the brake arm may grab the wheel even when the wheel is not engaged by the push rod, causing the caster to brake when it is not supposed to. Even worse, the brake arm may wedge into the wheel as it continues to turn, causing the caster to permanently lock up.

What is needed is an improved central braking mechanism for a high-load bearing caster.

SUMMARY OF THE INVENTION

The invention is directed to, but not limited by, one or more of the following non-exhaustive objects, separately or in combination:

to provide a high-load, high-performance caster with a central-locking system suitable for bariatric beds, the caster having two wheels mounted on an axle of a sturdy yoke integrally formed with a semi-cylindrical cap or flange covering the top surface of the gap between the wheels;

to provide a twin-wheeled caster with a spring-loaded double-armed brake lever central locking mechanism;

to provide caster wheels comprised of an aluminum-core disc and an annular cylindrical flange covered with elastomeric material, an inside, elastomeric-covered concave surface of the annular flange serving as a brake drum for the wheel;

to provide a pivot pin to guide the spring-loaded double-armed brake lever so that it pivots exclusively about a horizontal axis perpendicular to the direction of the wheels' forward rolling movement;

to provide a pivot block with an aperture for receiving the pivot pin for mounting the double-armed brake lever;

to provide two compression springs having sufficient spring force to bias the double-armed brake lever away from the wheel;

to provide recesses in the pivot block for anchoring an end of each of the compression springs, the opposite ends of the compression springs being disposed to provide a pushing force against a saddle portion of the double-armed brake lever in order to bias the brake arm away from the brake drum;

to provide an aperture extending vertically through the top and bottom of the pivot block in which to receive a flathead screw to mount the pivot block to the yoke;

to provide teeth on each arm of the brake lever to grab the elastomeric material on the inside surface of the corresponding wheel's annular flange in order to inhibit wheel rotation;

to provide smoother, wider, and flatter teeth than typically used or taught in the caster brake art to minimize wear of the elastomeric material on the wheel's annular flange;

to provide this caster for use on office furniture, computer furniture, and hospital beds, examples of the latter of which are disclosed in U.S. Pat. No. 6,115,860 to Vrzalik; U.S. Pat. No. 5,611,096 to Bartlett, et al.; and U.S. Pat. No. 4,638,519 to Hess; and PCT/US97/21285, filed Nov. 17, 1997, the details of all four of which are herein incorporated by reference; and

to provide this caster for use on bariatric products, including beds, chairs, wheelchairs, and walkers.

These and other aspects, objects, features, and advantages of the present invention will be readily apparent to those skilled in the art from the following detailed description taken in conjunction with the annexed sheets of drawings, which illustrate the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevated perspective view of a double-wheeled embodiment of a roller in the form of a caster.

FIG. 2 is another perspective view of the roller of FIG. 1, displaying the underside of the roller.

FIG. 3 is an elevated perspective view of the roller of FIG. 1, with one of the wheels removed, exposing a portion of the braking system therein.

FIG. 4 shows a vertical cross-section of a roller in the form of a caster, with the brake lever in an unlocked position.

FIG. 5 shows a vertical cross-section of the roller of FIG. 4, but with the brake lever in the locked position.

FIG. 6 is an exploded perspective view of the roller of FIG. 1, showing the relationship between the roller, the double armed brake lever, the pivot block, the flat headed socket screw that mounts the pivot block to the roller, and the bias springs that bias the arms of the brake lever away from the brake drum of the wheel.

FIG. 7 is a perspective view of the double-armed brake lever, illustrating its flattened teeth.

FIG. 8 is a perspective view of the pivot block.

FIG. 9 is another perspective view of the pivot block, with dashed lines revealing hidden edges.

FIG. 10 is a perspective view of the pivot pin that mounts the brake lever onto the pivot block.

DETAILED DESCRIPTION

Based on the description and illustrations provided herein, the many benefits provided by the invented structure and methods of utilization are apparent. These described benefits, as well as those that are inherent to those skilled in the art, fall within the scope of the invention of the present patent application as limited only by the claims appended hereto.

One embodiment of a caster **100** of the present invention includes a main caster body or yoke **130**. The yoke **130** includes a substantially cylindrical housing **133** strengthened by reinforcing ribs **134**. The housing **133** optionally surrounds and hides a swivel mechanism (not shown) of the yoke **130**. The yoke **130** also includes one or more reinforcing rib or flange members **132** that transfer load from the apparatus (such as a bariatric hospital bed) supported by the caster **100** to the wheel-bearing axle **114**. Flange members **132** extend radially from a central boss portion **192** (FIGS. 3, 6) of the axle **114** to the cylindrical housing **133**.

A semi-cylindrical cap or flange **135** extends from and is integral with the yoke **130**. The flange **135** surrounds or covers the top portion of the gap between the two wheels **110a**, **110b** of the caster, protecting the surrounded components from dust, spills, and the like. As illustrated best in FIGS. 3 and 6, a semicircular disc **136** extending radially from the boss portion **192** of the axle **114** to the flange **135** further reinforces the flange **135**.

A cylindrical socket **140** extends vertically from the top of the yoke **130** for receipt of a vertical pin or mount (not shown) for vertical attachment to the leg of a hospital bed such as a bariatric bed, a regular bed, a chair, or a piece of furniture or equipment (not shown). The cylindrical socket **140** houses a cam-operated plunger or push rod **190** (illustrated with broken lines in FIGS. 4 and 5). The push rod **190** engages a central locking or central braking mechanism, described in more detail below. To access the cam with a hex wrench or brake pedal, a hex wrench opening **142** is provided (FIGS. 1-3, 6). The wheels **110a**, **110b** of the caster **100** can be locked or unlocked by operating the cam between two or more positions. In an alternative embodiment, the push rod also engages the swivel mechanism of the caster **100** to enable a person to lock the wheel into a fixed orientation about the caster's vertical axis. In this alternative embodiment, the wheels **110a**, **110b** and the swivel mechanism can be simultaneously locked and unlocked, or the swivel mechanism locked independently of the wheels **110a**, **110b**, by operating the cam between three positions.

The two wheels **110a**, **110b** of the caster **100** are mounted on terminal spindles **115a**, **115b** protruding from opposite

sides of the reinforced central boss portion **192** of the axle **114** (FIG. 6). Each wheel **110a**, **110b** is preferably comprised of an aluminum-core disc **113a**, **113b** having an annular outer cylindrical flange **112a**, **112b** covered with elastomeric material. An elastomer-covered inside (concave) surface **122a**, **122b** of the annular flange **112a**, **112b** serves as a brake drum for the wheel **110a**, **110b**. The preferred composition of the elastomeric material is a proprietary blend of elastomers from Darcor[®] which it markets as part of its "LE" wheel, where "LE" stands for "low effort." Darcor[®], which is based in Toronto, Ontario, Canada, and which operates a website at <http://www.darcor.com>, describes its blend of elastomers as a long-life alternative to industrial rubber that delivers a smooth ride and is highly resistant to chemicals and extremely resistant to abrasion.

The wheels **110a**, **110b** further comprise hubs **111a**, **111b** that house bearing races to enable the wheels **110a**, **110b** to rotate about the spindles **115a**, **115b**. In this way, worn out bearing races can be simply replaced by removing and then repairing or replacing the wheels **110a**, **110b**. In a preferred embodiment, terminal outer portions of the spindles **115a**, **115b** are threaded, so that the wheels **110a**, **110b** can be retained on the spindles **115a**, **115b** with threaded retaining nuts (not shown). Replaceable spacers **116** (FIG. 6) space the hubs **111a**, **111b** of the wheels **110a**, **110b** a slight distance from the boss **192**.

The central locking assembly comprises the push rod **190**, a pivot block **240**, a brake lever **200**, and a pivot pin **280** for mounting the brake lever **200** to the pivot block **240**. The central locking assembly also includes two compression springs **270**, **272** disposed between the pivot block **240** and the brake lever **200**. The central locking assembly also comprises a flat head socket screw **276** for mounting the pivot block **240** to the yoke **130**.

The brake lever **200**, which is vaguely reminiscent of a ram skull, comprises a saddle **210** having a substantially planar dimension and two curved brake arms **220** (preferably metallic) that extend upwardly from the saddle **210** in a direction that is initially substantially perpendicular to the planar dimension of the saddle **210**. The brake arms curve away from their initial, substantially perpendicular, direction, in a direction away from the saddle **210**. More particularly, the outer, engaging surfaces of the brake arms **220** are substantially semi-circular and arc across substantially parallel planes that are substantially perpendicular to the planar dimension of the saddle **210**. The brake arms **220**, which are connected to the saddle **210** on opposite sides of the saddle **210**, also have approximately equal dimensions. Furthermore, the separation between brake arms **220** remains approximately equal throughout their curvilinear dimensions.

Several flattened teeth **230** are disposed on the convex surface of each of the brake arms **220**. The flattened teeth **230** of the brake arm **220** are disposed to engage the inside elastomer-covered inside surface **122a**, **122b** of the annular flange **112a**, **112b** of the wheel **110a**, **110b**. Flattened teeth **230** are preferred because they do not lock up as easily on the elastomeric material. Furthermore, they are less likely to break off or cause premature damage and wear to the elastomeric material.

Pivot pin receiving holes **202** extend horizontally through the brake arms **220** proximate the region where the brake arms **220** are joined to the saddle **210**. When the brake lever **200** is mounted, via a pivot pin **280**, on the pivot block **240**, the brake lever **200** pivots about the axis defined by the holes **202**. Because this structure causes the brake lever **200** to

pivot exclusively about a horizontal axis perpendicular to the direction of the wheels' forward rolling movement, the brake arm **220** is less likely to malfunction by jamming against the wheel disc **113a**, **113b** or the inside surface **122a**, **122b** of the flange **112a**, **112b**.

The saddle **210** of the brake lever **200** includes a pushpin mount **214** for mounting a pushpin **216**. The push rod **190** engages the pushpin **216** in order to leverage the brake arm **220** about the pivot pin **280**.

The pivot block **240** comprises a substantially rectangular solid core. An aperture **242** for receiving the pivot pin **280** extends all the way through a transverse dimension (the transverse dimension being perpendicular to the direction of the wheel's forward-rolling movement) of the pivot block **240**. A centrally located aperture **250**, perpendicular to and intersecting with aperture **242**, extends vertically through the pivot block. The aperture is tapered at one end in order to receive a flat head hex socket screw **276**. The flat head hex screw **276** is provided to mount the pivot block **240** to the yoke **130**.

It will be seen that the saddle **210** of the brake lever **200** includes a hole **212** corresponding to the centrally located aperture **250**. The hole **212** provides access to the socket screw **276** when the brake lever **200** is mounted on the pivot block **240**. A hex wrench can be inserted through the hole **212** in order to tighten or loosen socket screw **276**.

Two substantially cylindrical recesses or cavities **246**, **248** disposed on opposite sides of the centrally located aperture **250** provide means for anchoring an end of each of the compression springs **270**, **272**. When mounted, the compression springs **270**, **272** engage the saddle **210** of the brake lever **200** and bias the brake arms **220** away from the inside surfaces **122** of the annular flanges of the wheels **110a**, **110b**. The pivot block also comprises a recess **252** to make room for the boss **192** of the axle **114**.

The pivot pin **280** itself has a substantially cylindrical shape. The diameter of the pivot pin **280** is relatively constant throughout most of the length of the pivot pin **280**, except near its center, where it tapers down (as depicted by beveled surfaces **285** and **287**) to a smaller diameter. When the brake mechanism is assembled, the socket screw **276** engages beveled surfaces **285** and **287** to retain the pivot pin **280** in place.

Although the foregoing specific details describe various embodiments of the invention, persons reasonably skilled in the art will recognize that various changes may be made in the details of the method and apparatus of this invention without departing from the spirit and scope of the invention as defined in the appended claims. Therefore, it should be understood that, unless otherwise specified, this invention is not to be limited to the specific details shown and described herein.

We claim:

1. A central braking caster comprising:

a connecting apparatus;

a wheel mounted on the connecting apparatus, the wheel having a rotational axis, the wheel also having a cylindrical flange with the inner surface thereof accessible as a brake drum;

a pivot pin mounted on the connecting apparatus and oriented in a direction parallel to the rotational axis of the wheel;

a brake lever mounted on the pivot pin, whereby the brake lever is disposed to pivot exclusively about a horizontal axis parallel to the rotational axis of the wheel;

the brake lever having a brake arm, the brake arm having a convexly curved portion disposed to directly engage the brake drum of the wheel; and

one or more compression springs each having a first end and a second end, the first end of each compression spring being seated on the connecting apparatus in fixed relation to the rotational axis of the wheel, the second end of each compression spring pressing against a portion of the brake lever to bias the brake arm away from the brake drum.

2. The central braking caster of claim 1, further comprising elastomeric material that covers the inner surface of the brake drum.

3. The central braking caster of claim 2, further comprising a plurality of flattened teeth disposed on the convexly curved portion of the brake arm, the teeth being disposed, when the brake arm is engaged with the brake drum, to grab the elastomeric material on the brake drum in order to inhibit wheel rotation.

4. The central braking caster of claim 1, further comprising a plurality of flattened teeth disposed on the convexly curved portion of the brake arm.

5. The central braking caster of claim 1, further comprising a cylindrical socket mounted to the connecting apparatus and housing a plunger operable to transfer force to the brake lever in order to urge the brake arm of the lever toward the brake drum.

6. The central braking caster of claim 5, further comprising a pushpin mounted on one end to the brake lever, the other end of the pushpin being positioned in operational contact with the plunger.

7. The central braking caster of claim 6, wherein the brake lever comprises a plate portion having a top face and a bottom face opposite the top face, the one or more compression springs pressing against the top face of the plate portion, the pushpin also being mounted on the top face of the plate portion, and the plunger being operable to push against the pushpin to force the brake arm to engage the brake drum.

8. The central braking caster of claim 1, wherein the brake lever comprises a pivot pin hole disposed in the brake arm of the brake lever.

9. The central braking caster of claim 1, comprising a second wheel mounted on the connecting apparatus.

10. A twin-wheeled central locking caster comprising:

a yoke;

first and second wheels having a rotational axis mounted on the yoke, each wheel having a cylindrical flange with the inner surface thereof accessible as a brake drum;

a pivot pin mounted to the yoke and oriented in a direction parallel to the rotational axis of the wheels;

a brake lever mounted on the pivot pin, whereby the brake lever is disposed to pivot exclusively about a horizontal axis parallel to the rotational axis of the wheels;

the brake lever having first and second brake arms, the first brake arm having a convexly curved portion disposed to directly engage the brake drum of the first wheel, the second brake arm having a convexly curved portion disposed to directly engage the brake drum of the second wheel; and

one or more compression springs each having a first end and a second end, the first end of each compression spring being seated in fixed relation to the yoke, the second end of each compression spring pressing against a portion of the brake lever to bias the brake arm away from the brake drum.

11. The central locking caster of claim 10, further comprising a pivot block mounted on the yoke, the pivot block having an aperture to receive the pivot pin, the pivot pin being mounted on the pivot block.

12. The central locking caster of claim 11, wherein the pivot block further comprises, for each compression spring, a recess to serve as a seat for the first end of the compression spring.

13. The central braking caster of claim 11, the pivot block further comprising a mounting aperture extending through the pivot block in a direction perpendicular to and intersecting with the aperture for the pivot pin, the mounting aperture being shaped to receive a flathhead screw to mount to the pivot block to the yoke.

14. The central braking caster of claim 10, wherein the brake drum of the first wheel faces the brake drum of the second wheel.

15. The central braking caster of claim 10, a plurality of flattened teeth disposed on the convexly curved portions of each of the brake arms.

16. The central braking caster of claim 10, further comprising a cylindrical socket extending vertically from the top of the yoke, the cylindrical socket housing a plunger openable to transfer force to the brake lever in order to urge the brake arms of the lever toward the brake drums of the wheels.

17. The central braking caster of claim 16, further comprising a pushpin mounted on one end to the brake lever, the other end of the pushpin being positioned in operational contact with the plunger.

18. A bed mounted on a plurality of central locking casters, each central locking caster comprising:

a yoke;

first and second wheels having a rotational axis mounted on the yoke, each wheel having a cylindrical flange with the inner surface thereof accessible as a brake drum;

a pivot pin mounted to the yoke and oriented in a direction parallel to the rotational axis of the wheels;

a brake lever mounted on the pivot pin, whereby the brake lever is disposed to pivot exclusively about a horizontal axis parallel to the rotational axis of the wheels;

the brake lever having first and second brake arms, the first brake arm having a convexly curved portion disposed to directly engage the brake drum of the first wheel, the second brake arm having a convexly curved portion disposed to directly engage the brake drum of the second wheel; and

one or more compression springs each having a first end and a second end, the first end of each compression spring being seated in fixed relation to the yoke, the second end of each compression spring pressing against a portion of the brake lever to bias the brake arm away from the brake drum.

19. The bed of claim 18, each central locking caster further comprising a pivot block mounted on the yoke, the pivot block having an aperture to receive the pivot pin, the pivot pin being mounted on the pivot block.

20. The bed of claim 18, wherein the bed is a bariatric bed.

21. The bed of claim 18, a plurality of flattened teeth disposed on the convexly curved portions of each of the brake arms.

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