(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 January 2009 (15.01.2009)

PCT

(10) International Publication Number
WO 2009/009619 A2

(51) International Patent Classification:
B60B 7/20 (2006.01)

(21) International Application Number:
PCT/US2008/069562

(22) International Filing Date: 9 July 2008 (09.07.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2007-180403 9 July 2007 (09.07.2007) JP

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:
— *of inventorship (Rule 4.17(iv))*

Published:
— *without international search report and to be republished upon receipt of that report*

(54) **Title:** WHEEL COVER HOLDER AND WHEEL COVER

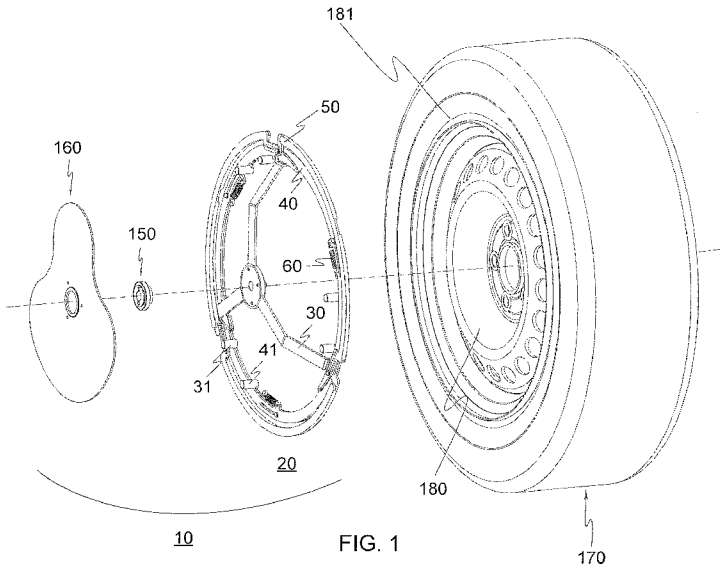


FIG. 1

(57) **Abstract:** Wheel cover assemblies including wheel cover holders and wheel covers are described. The wheel cover holders may be capable of being mounted to and dismounted from a wheel having a rim portion. The wheel cover holders may be mounted to the inside or outside surface of the rim portion, or to both surfaces. Wheel covers may be attached to and detached from the wheel cover holders manually, without the use of external tools. Wheel covers may include unitarily formed ridges for strength, unitarily formed posts to facilitate attaching to the wheel cover holders, and/or any of a variety of optional features such as control vanes and cutout portions. Attractive communications capable of being displayed on the wheel covers include three dimensional communications.

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WHEEL COVER HOLDER AND WHEEL COVER

BACKGROUND

Field

This disclosure generally relates to the field of vehicle wheel mounts and vehicle wheel covers.

Description of the Related Art

A wheel cover may be attached to a vehicle wheel in order to provide a protective cover to the wheel, rim portion, and attached tire. A wheel cover may also provide an ornamental surface generally facing away from the vehicle, orthogonal to the direction of travel of the wheel as it rotates contacting the ground.

Conventional wheel covers typically show angular symmetry of design about the center of rotation of the vehicle wheel. Wheel covers are typically secured to a vehicle wheel and rotate along with the wheel when the vehicle is in motion. At all but very low vehicle speeds, even non-symmetric pattern or design will not be readily discernable by the human eye as the vehicle is in motion. A smoothly blurred disk shape that appears uniform, or that appears to contain a plurality of annular rings of different color and/or brightness, may be visible, depending upon the actual wheel cover design.

It may be advantageous to create a wheel cover holder capable of holding a wheel cover in a non-rotating state. If the wheel cover does not rotate together with a vehicle wheel when the wheel is in motion, a pictorial design, written message, or other visual image may be easily perceived by people as the vehicle passes. A vehicle may display a communication such as a commercial or non-commercial advertisement on the vehicle body, but areas without any communication over the wheels on the vehicle may detract from the overall image or scene. The wheel cover may serve as a medium for expanding the communication area, or displaying an independent

communication. Advertising may be especially attractive as an income generating means for fleet operators who operate trucks, busses, taxicabs, and the like.

Further, employing a three dimensional communication on a wheel cover may be more effective at catching the eye of a viewer of the wheel cover, and could be useful in creating useful commercial and/or non-commercial advertisements.

As discussed in US 6,120,104, a weight may be used to help keep the wheel cover from rotating along with the wheel. The effectiveness of the weight in preventing undesirable rotation of the wheel cover may depend upon its specific shape and makeup.

Commercial acceptance of wheel cover holders used to hold advertisements may depend upon how readily and/or easily a cover displaying one advertisement can be swapped out for a different cover displaying another advertisement. Difficulty in exchanging the advertisement covers may require a substantial amount of time and/or labor, leading to inefficiencies in fleet usage, and rejection of the wheel cover by both fleet operators and those employees who are tasked with swapping old advertisements for new.

Wheel cover holders must be securely mounted in some fashion to a vehicle wheel. US 5,957,542 teaches that wheel covers should be difficult to remove, in the interest of theft prevention. Commercial users of wheel covers for advertising may be more concerned with the ease of installation, and removal, of the wheel cover holder itself onto a vehicle wheel than with conversely making the cover difficult to remove. Commercial vehicle fleets may be more likely to be parked in a secure location at times when the vehicles are not in use, reducing the need for theft resistant designs.

Advertisements may naturally run for a specific period of time. Once this period has lapsed, a new advertisement may be mounted to the wheel cover holder. If for some reason a new advertisement is not available, a fleet operator may decide to use a wheel cover promoting the fleet operator itself, or may opt to remove the wheel cover holder from the vehicle wheel and

replace it with a conventional wheel cover. Ease of removal of the wheel cover holder may then be important. Further, inspection of the wheel may need to be performed on a regular basis. A difficult to remove wheel cover holder may lead to resistance by fleet operators to its use.

It may be beneficial to provide a wheel cover holder that can be easily secured to and removed from a vehicle wheel, manually, without the use of external tools. It may also be beneficial to provide a wheel cover holder to which a wheel cover can be easily mounted, and from which a wheel cover can be easily removed, manually, without the use of external tools. A wheel cover holder that addresses one or more of these factors is desirable.

BRIEF SUMMARY

This disclosure relates to a wheel cover holder to which an ornamental wheel cover can be coupled without using any external tools. The wheel cover holder itself may be readily mounted to a vehicle wheel, without using any external tools, and substantially reduce, but not eliminate, movement of the ornamental wheel cover during operation of the vehicle. This disclosure also relates to a mechanism, useful for a wheel cover holder, capable of converting rotational motion into linear motion in a plurality of radial directions. This disclosure further relates to a wheel cover capable of being mounted to a wheel cover holder.

At least one embodiment may be summarized as a wheel cover assembly capable of being mounted to, and removed from, a wheel having a rim portion, without loosening any fasteners attaching the wheel to a vehicle, including a wheel cover holder including: a base mount lockably attachable to the rim portion of the wheel; a bearing assembly physically coupled to the base mount and having a center of mass; a holder plate physically coupled to the bearing assembly and having a center of mass, the center of mass of the holder plate offset from the center of mass of the bearing assembly; and a stopper mechanism physically coupled to the holder plate, the stopper mechanism lockably attachable to a wheel cover.

The wheel cover assembly may further include a wheel cover selectively mountable to and dismountable from the wheel cover holder without the use of tools.

The base mount may include a wheel snap-on mechanism including a spoke ring physically coupled to the bearing mechanism, the spoke ring comprising a ring portion, a bearing assembly coupling portion, and at least two spoke portions that physically couple the ring portion with the hub center portion; an adjustment ring rotatably slidably coupled to the spoke ring; and at least two engagement members slidably coupled to the spoke ring, the engagement members configured to engage at least part of the rim portion. The engagement members may be rotatably slidably coupled to the spoke ring.

The wheel cover assembly may further include at least one spring that biasingly couples the spoke ring and the adjustment ring. The spoke ring may further include a spoke ring tab portion, and the adjustment ring includes an adjustment ring tab portion.

The adjustment ring may include at least one adjustment ring slot and the spoke ring may include at least one spoke ring slot, a distance between a geometric center of the adjustment ring and the at least one adjustment ring slot may vary along a length of the at least one adjustment ring slot; and further comprising at least one fastener that may rotatably and slidably couple the spoke ring and the adjustment ring together, the at least one fastener passing through a respective one of the at least one adjustment ring slot and the at least one spoke ring slots. When the spoke ring tab portion and the adjustment ring tab portion are manually moved relatively toward one another, a force applied to the at least one spring may tend to cause the adjustment ring to rotatably slide relative to the spoke ring along the one or more radial spoke ring slots and the one or more adjustment ring slots, and may tend to cause the two or more engagement members to slide relative to the spoke ring and the adjustment ring, moving from initial locations to engaging open locations. When the snap-on mechanism is moved proximate the rim portion and then a force applied to the at least one spring is lessened by releasing the spoke ring tab portion and

the adjustment ring tab portion, the at least two engagement members may slide relative to the spoke ring and the adjustment ring, moving from the engaging open locations toward, but not completely to, the initial locations, lockably attaching the wheel cover holder to the rim portion as the at least two engagement members engage at least part of the rim portion.

The base mount may include a base hub including at least two arm portions that extend toward an outer edge of the rim portion when the wheel cover holder is mounted to the wheel; a tightening lever rotatably coupled to at least one of the arm portions of the base hub at a first coupling point; and an engagement arm rotatably coupled to the tightening lever at a second coupling point, the engagement arm comprising an end portion configured to engage an outer edge of the rim portion when the engagement arm is in a tensioned state. A line connecting the first coupling point and the second coupling point may form an angle with a line radiating outward from a geometric center of the base mount along the arm portion to which the tightening lever is coupled, the angle differing substantially from zero degrees. Moving the second coupling point to a location closer to a geometric center of the base hub may tend to lockably couple the wheel cover holder to the wheel as the end portion of the engagement arm physically engages at least part of the outer edge of the rim portion.

The base mount may include a base hub including at least two arm portions that extend toward an outer edge of the rim portion when the wheel cover holder is mounted to the wheel; a ratchet assembly rotatably coupled to the base hub; and an engagement arm rotatably slidably coupled to the ratchet assembly at a first coupling point, the engagement arm comprising an end portion configured to engage at least part of the outer edge of the rim portion when the engagement arm is in a tensioned state.

The wheel cover assembly may further include a ratchet hook rockably coupled to the base hub, wherein the ratchet assembly may include: a ratchet hub center member; a ratchet disk rotatably coupled to the base hub, the ratchet disk having a substantially round annular plate shape including a

regular jagged shape ratchet portion on the outer circumference of the ratchet disk; and at least one arm fixedly coupled to the ratchet disk. The ratchet disk may include at least one slot, the distance from a geometric center of the ratchet disk to the slot differing along a length of the slot, and wherein at least one fastener passes through the at least one slot, the at least one fastener rotatably coupling the base hub to the ratchet assembly and slidably rotatably coupling the ratchet assembly to the engagement arm. Rotating the ratchet assembly in a first rotational direction via the lever arm may cause the engagement arm to slide substantially along a radial line passing through a geometric center of the base hub, tending to lockably couple the wheel cover holder to the wheel as the end portion of the engagement arm engages at least part of the outer edge of the rim portion. The ratchet hook may engage with the jagged portion of the ratchet disk, tending to prevent the ratchet disk from rotating in a second rotational direction opposite the first rotational direction. The end portion of the engagement arm may have a substantially flat plane shape. The end portion of the engagement arm may have a substantially hook shape.

The base mount may further include a hold bar rotatably coupled to the engagement arm, wherein rotating the hold bar causes a portion of the hold bar to engage at least part of an inner edge of the rim portion.

At least one embodiment may be summarized as a wheel cover assembly which permits a wheel cover to be fixedly attached to, and detached to a wheel, manually, without the use of external tools, including a wheel cover holder, including: a base mount lockably attachable to a wheel; a bearing assembly coupled to the base mount; a holder plate coupled to the bearing assembly, the center of mass of the holder plate offset from the center of mass of the bearing assembly; and a stopper mechanism coupled to the holder plate, the stopper mechanism lockably attachable to a wheel cover. The stopper mechanism may be a snap-in-place mechanism including two engaging rings; and a spring that slidably rotatably couples the two engaging rings together. Each of the two engaging rings may include at least one engaging clamp

portions and at least one portions. The two engaging rings may be arranged back to back, at a non-zero angular offset. At least one engaging clamp portion on one of the two engaging rings may be proximate at least one engaging clamp portion on the other of the two engaging rings, a non-zero space therebetween. When a force is applied to the spring by movement of at least one lever on one of the two engaging rings toward at least one lever on the other of the two engaging rings, the two engaging rings may rotatably slide with respect to each other, and causes the non-zero space to become larger.

The wheel cover assembly may further include a wheel cover, having a post with an engaging groove portion having a lateral dimension larger than the non-zero space, wherein movement of the wheel cover to a location proximate to the snap-in-place mechanism, and then a reduction of a force applied to the spring by a release of at least one lever on both of the two engaging rings, causes the non-zero space to become smaller until the at least one engaging clamp portion on one of the two engaging rings and the at least one engaging clamp portion on the other of the two engaging rings to lockably attach to the post. The stopper mechanism may include a stopper ring; a stopper link rotatably slidably coupled to the stopper ring; and at least two engaging links rotatably slidably coupled to the stopper ring.

The wheel cover assembly may further include a wheel cover, the wheel cover comprising at least two posts, each of the posts having at least one respective a hole, where the posts are oriented substantially parallel to an axis of rotation of the vehicle wheel when the wheel cover is mounted to the vehicle wheel. The stopper mechanism may include a stopper ring; rotating means for rotating the stopper ring, the rotating means coupled to the stopper ring; and at least two engaging links rotatably slidably coupled to the stopper ring.

The wheel cover assembly may further include a wheel cover, the wheel cover comprising at least two posts, each of the posts having a respective hole, where the posts are oriented substantially parallel to an axis of rotation of the vehicle wheel when the wheel cover is mounted to the vehicle wheel. The posts may be located in positions readily visible to a user installing

the wheel cover onto the wheel cover holder. End portions of each of the at least two engaging links may be slidably engagable with at least one of the posts via the hole in the posts when the stopper link is slidably moved in a first direction substantially toward a geometric center of the stopper mechanism. End portions of each of the at least two engaging links may be lockably slidably engagable with at least one of the posts via the hole in the posts when the stopper link is slidably moved along a substantially hook shape path, initially in a first direction substantially toward a geometric center of the stopper mechanism. The hook shape path may correspond to a guide path opened in the stopper link. The holder plate may include a locking projection, and the locking projection protrudes into a hole opened in the stopper link when the stopper link is displaced in a second direction, substantially differing from the first direction, once the at least two engaging links have each slidably engaged at least one of the posts. A respective end portion of each of the at least two engaging links may be slidably engagable with at least one of the posts when the rotating means is manually rotated. A respective end portion of each of the at least two engaging links may be lockably slidably engagable with at least one of the posts after the rotating means has been rotated to a rotation limit point.

At least one embodiment may be summarized as a wheel cover capable of being coupled to a vehicle wheel through use of a suitable wheel cover holder, including a substantially dish shape member having a diameter, a depth, and at least one communication surface capable of bearing a communication; at least one ridge that protrudes from the dish shape member substantially parallel to an axis of rotation of the vehicle wheel, where the dish shaped member and the at least one ridge are a unitary structure; and at least one post that protrudes from the dish shape member substantially parallel to the axis of rotation of the vehicle wheel, where the dish shaped member and the at least one post are a unitary structure. The at least one ridge may present in a regular pattern shape. The at least one post may include a hole. The at last post may include an engaging groove portion. The dish shape member may include a passage.

The wheel cover may further include at least one control vane that protrudes from the dish shape member in a direction substantially parallel with the axis of rotation of the vehicle wheel, where the dish shaped member and the at least one control vane are a unitary structure.

The wheel cover may further include a visible communication disposed on the communication surface. The communication may be a three-dimensional communication. The communication may be selectively removable from the communication surface. The communication may include a thin curvilinear portion substantially covering the communication surface, and a three dimensional portion that protrudes from the communication surface at least in a direction orthogonal to a direction of travel of the vehicle wheel as the vehicle wheel rotates while in contact with a portion of ground. The three dimensional portion may include a blister covering capable of contacting the thin curvilinear portion over a substantially non-zero surface area. The three dimensional portion may be adhered to the communication surface using an adhesive.

At least one embodiment may be summarized as an engagement device configured to engage a member, the engagement device transforming rotational motion about a point into substantially linear motion along a plurality of radials originating substantially at the point, including a base having at least two slots; at least two engaging links slidably coupled to the base by at least one fastener via the at least two slots; a rotatable ring capable of rotating about an axis through a geometric center thereof, the at least two engaging links rockably coupled to the rotatable ring; wherein the at least two engaging links are adapted to be placed in engagable relation to the member.

At least one embodiment may be summarized as an engagement device to engage a member, the engagement device transforming rotational motion about a point into substantially linear motion along a plurality of radials originating substantially at the point, including a base; at least two engaging links each having a slot, each of the at least two engaging links slidably coupled to the base by at least one fastener via said slot; a rotatable ring capable of

rotating about an axis through a geometric center thereof, the at least two engaging links rockably coupled to the rotatable ring; wherein the at least two engaging links are adapted to be placed in engagable relation to the member. End portions of each of the at least two engaging links may be slidably engagable with at least one of a plurality of holes in the member when the ring is rotated. End portions of each of the at least two engaging links may be lockably slidably engagable with at least one of a plurality of holes in the member when the ring is rotated.

The engagement device may further include rotating means for rotating the ring.

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At least one embodiment may be summarized as a wheel cover holder including a base mount lockably attachable to a vehicle wheel, the base mount having a base mount center hole capable of accepting a fastener with a longitudinal axis, the base mount comprising a first inner sidewall portion and a second inner sidewall portion each adjacent to the base mount center hole; a bearing assembly coupled to the base mount; a holder plate coupled to the bearing assembly, the center of mass of the holder plate offset from the center of mass of the bearing assembly; and a stopper mechanism coupled to the holder plate, the stopper mechanism lockably attachable to a wheel cover. The first inner sidewall portion may be substantially parallel to the longitudinal axis of the fastener, and the second inner sidewall portion forms a first taper angle with respect to the first sidewall portion, the angle differing substantially from 180 degrees. The fastener may include an external threaded portion, and the fastener couples the base mount to the bearing assembly. The fastener may include a head portion having a second taper angle with respect to the longitudinal axis of the fastener. The first taper angle may differ substantially from the second taper angle. The first taper angle may be greater than the second taper angle.

At least one embodiment may be summarized as a wheel cover holder including a base mount lockably attachable to a vehicle wheel; a bearing

assembly coupled to the base mount; a holder plate coupled to the bearing assembly, the center of mass of the holder plate offset from the center of mass of the bearing assembly, the holder plate comprising: an arm portion center coupled to the bearing assembly; at least three arms extending from the arm center portion; and an arciform coupling member that couples at least two of the at least three arms; and a stopper lever; and a wheel cover. A plurality of holes may be formed in the stopper lever.

The wheel cover holder may further include a spacer interposed between the base mount and the bearing assembly.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

In the drawings, identical reference numbers identify similar elements or acts. The sizes and relative positions of elements in the drawings are not necessarily drawn to scale. For example, the shapes of various elements and angles are not drawn to scale, and some of these elements are arbitrarily enlarged and positioned to improve drawing legibility. Further, the particular shapes of the elements as drawn, are not intended to convey any information regarding the actual shape of the particular elements, and have been solely selected for ease of recognition in the drawings.

Figure 1 is an exploded isometric view of a wheel cover holder in relation to a vehicle wheel according to one illustrated embodiment.

Figure 2 is an isometric view of the wheel cover holder of Figure 1 mounted to a vehicle wheel.

Figure 3 is an exploded isometric view of a wheel snap-on mechanism of the wheel cover holder of Figure 1, including a spoke ring, an adjustment ring, and semi-circular engagement members.

Figure 4 is an isometric view of a spoke ring and adjustment ring, with an enlarged portion that shows a spring that couples the spoke ring and the adjustment ring of Figure 3.

Figure 5A is an isometric view of a wheel snap-on mechanism with an enlarged portion that illustrates a part of the wheel snap-on mechanism,

showing states before and after the adjustment ring and the spoke ring are rotated relative to each other by moving tab portions thereon, extending the spring.

Figure 5B is a plan view of the wheel snap-on mechanism, showing motion of the semi-circular engagement members before and after the adjustment ring and the spoke ring are rotated relative to each other.

Figure 6A is an isometric view of another embodiment of the wheel snap-on mechanism, including round shape engagement members.

Figure 6B is a plan view of the wheel snap-on mechanism, showing motion of the round shape engagement members before and after the adjustment ring and the spoke ring are rotated relative to each other.

Figure 7A is an isometric view of another embodiment of the wheel snap-on mechanism, including hook shape engagement members.

Figure 7B is a plan view of the wheel snap-on mechanism of Figure 7A, showing motion of the hook shape engagement members before and after the adjustment ring and the spoke ring are rotated relative to each other.

Figure 8 is an exploded isometric view of a wheel cover holder in relation to a vehicle wheel according to a further illustrated embodiment.

Figure 9 is an isometric view of the wheel cover holder of Figure 8 mounted to a vehicle wheel.

Figure 10 is a plan view of a base mount of the wheel cover holder of Figure 8 in an initial state, and including a close-up view of a first coupling point and a second coupling point where an arm portion, a tightening lever, and an engagement arm are coupled.

Figure 11 is a plan view of the base mount of Figure 10 in a locked state, including a close-up view of a portion thereof.

Figures 12A and 12B are cross sectional views of the Figure 10 taken along A-A and Figure 11 taken along B-B, respectively.

Figure 13A is a side elevational view showing a positional relationship between the arm portion, the tightening lever, and the engagement arm of the base mount of Figure 10 when in an initial state or configuration.

Figure 13B is a side elevational view showing a positional relationship between the arm portion, the tightening lever, and the engagement arm of the base mount of Figure 10 as the second coupling point is displaced relative to the first coupling point, moving the engagement arm toward the arm portion.

Figure 13C is a side elevational view showing a positional relationship between the arm portion, the tightening lever, and the engagement arm of the base mount of Figure 10 as the second coupling point is further displaced relative to the first coupling point, moving the engagement arm further toward the arm portion.

Figure 13D is a side elevational view showing a positional relationship between the arm portion, the tightening lever, and the engagement arm of the base mount of Figure 10 when in a locked state.

Figure 14 is an isometric view that shows an optional hold bar coupled to the end of the engagement arm of the base mount of Figure 10.

Figure 15 is an exploded isometric view of a wheel cover holder in relation to a vehicle wheel according to another illustrated embodiment.

Figure 16 is an isometric view of the wheel cover holder of Figure 15 mounted to a vehicle wheel.

Figures 17A to 17C are plan views of a base mount of the wheel cover holder including a ratchet assembly of Figure 15, in an initial state, an intermediate state, and a locked state, respectively.

Figure 18 is an isometric view of a wheel cover according to another illustrated embodiment.

Figure 19 is an isometric view of the wheel cover of Figure 18 mounted to a vehicle wheel.

Figure 20 is an isometric view of a wheel cover including a post according to another illustrated embodiment.

Figure 21 is an isometric view of a wheel cover having a cutout area according to another illustrated embodiment.

Figure 22 is an isometric view of a wheel cover including a cutout area and a control vane according to another illustrated embodiment.

Figure 23 is an isometric view of a wheel cover mounted to a wheel, the wheel cover including a visible communication.

Figure 24 is an isometric view of a curvilinear communication portion attachable to a wheel cover mounted to a wheel.

Figure 25 is an isometric view of a three dimensional communication portion attachable to a curvilinear communication portion already attached to a wheel cover mounted to a wheel.

Figure 26 is an isometric view of a three dimensional communication portion attachable inside a curvilinear communication portion already attached to a wheel cover mounted to a wheel.

Figure 27 is an isometric view of a three dimensional communication portion attachable to a wheel cover mounted to a vehicle.

Figure 28 is an exploded isometric view of a wheel cover holder in relation to a vehicle wheel according to another illustrated embodiment.

Figures 29A and 29B show isometric and plan views, respectively, of the stopper mechanism of Figure 28 in both engaging open and locked states.

Figure 30 is an isometric view of a wheel cover including unitarily formed posts with grooves.

Figure 31 is an exploded isometric view of a wheel cover holder in relation to a vehicle wheel according to another illustrated embodiment.

Figure 32 is an exploded isometric view of a stopper mechanism of the wheel cover holder of Figure 31.

Figures 33A and 33B are plan views of the stopper mechanism of the wheel cover holder of Figure 31 coupled to a bearing assembly and a holder plate, in open and locked states, respectively.

Figure 34 is an isometric view of a wheel cover including unitarily formed posts with holes therethrough.

Figure 35 are plan views that show the relative position of a fastener and a glide path in the stopper mechanism of Figure 32 as the stopper mechanism is moved from an initial state to a locked state by displacing a stopper link in a first direction and then in a second direction.

Figure 36 are plan views that show the relative position of a fastener and a glide path in the stopper mechanism of Figure 32 as the stopper mechanism is moved from an initial state to a locked state by displacing a stopper link initially in a first direction.

Figure 37 is a plan view of a holder plate of a stopper mechanism including a locking projection according to another illustrated embodiment, including an enlarged view of a portion thereof.

Figure 38 is an isometric view of the holder plate and projection of Figure 37.

Figure 39A shows a center bolt and a base mount with a center hole according to another illustrated embodiment.

Figure 39B shows a cross sectional view of the center bolt and base mount center hole of Figure 39A.

Figure 40 is a perspective view of a wheel cover, stopper mechanism, and bearing assembly according to another illustrated embodiment.

Figure 41 is a perspective view of the stopper mechanism of Figure 41.

Figures 42A, 42B, and 42C are plan views of three embodiments of a stopper lever of the stopper mechanism of Figure 40.

DETAILED DESCRIPTION

In the following description, certain specific details are included to provide a thorough understanding of various disclosed embodiments. One skilled in the relevant art, however, will recognize that embodiments may be practiced without one or more of these specific details, or with other methods,

components, materials, etc. In other instances, well-known structures associated with mechanical couplings including, but not limited to, fasteners and/or housings have not been shown or described in detail to avoid unnecessarily obscuring descriptions of the embodiments.

Unless the context requires otherwise, throughout the specification and claims which follow, the word “comprise” and variations thereof, such as, “comprises” and “comprising” are to be construed in an open, inclusive sense, that is, as “including, but not limited to.”

Reference throughout this specification to “one embodiment,” or “an embodiment,” or “in another embodiment” means that a particular referent feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment. Thus, the appearance of the phrases “in one embodiment,” or “in an embodiment,” or “in another embodiment” in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments.

It should be noted that, as used in this specification and the appended claims, the singular forms "a," "an," and "the" include plural referents unless the content clearly dictates otherwise. Thus, for example, reference to an electrically powered device including "a power source" includes a single power source, or two or more power sources. It should also be noted that the term "or" is generally employed in its sense including "and/or" unless the content clearly dictates otherwise.

As used herein the term “wheel cover” means a functional and/or ornamental covering that extends over a portion of, or the entirety of, a surface of a wheel that faces outward from a vehicle to which it is attached.

As used herein the term “vehicle” means a conveyance by which someone or something can travel, or be carried or transported. Vehicles may be powered by a motor, engine, or other means, or be operable manually by a user.

As used herein the term “holder” means a device or apparatus capable of receiving and maintaining an object within a space in the local vicinity of the holder. Holders do not necessarily maintain the object in a fixed relationship with the holder, but may allow the held object to move within the space.

As used herein, the terms “locked,” “locked state,” “lockably attachable,” “lockably coupleable,” “lockably engagable,” “lockably slidably engagable” and variants thereof mean that two or more elements may be coupled by engaging one with the other, the engagement resulting in a stable positional relation between the two or more elements, except possibly for a small amount of play, where a certain amount of energy or driving force is necessary to uncouple the two or more elements from each other.

As used herein, the terms "wheel rim," "rim," and variants thereof mean an outer edge, border, margin, or brink of a vehicular wheel, often forming a connection between the wheel and an attached tire.

As used herein, the terms "mount," "mounting," and variants thereof when used as a verb to describe a positional relationship between two objects, or when used as a noun to describe a constitutive element normally positioned intermediate two objects, mean that the two objects are in a coupled state.

As used herein, the term "communication" and variants thereof means a visual depiction of text and/or images intended to impart thoughts, opinions, news, views, or other information to a viewer who sees the visual depiction. A communication may include commercial and/or non-commercial advertising, as well as information for the benefit of the viewer that may not be classified as advertising, as well as aesthetic information commonly referred to as art.

As used herein, the term “visible” and variants thereof when used as an adjective, generally in conjunction with “communication,” means that the communication or other modified subject can be seen by a person or viewer as he or she goes about his or her daily routine, usually outdoors, without the need

to view the communication from at specified location, at a specified angle, or while moving their head or body in any specified manner.

As used herein, the term "three-dimensional" and variants thereof means having, or appearing to have, a depth dimension in addition to width and height. No minimum depth to width or depth to height ratios are specified, but when used referring to a communication visible on a wheel cover, the depth dimension of the communication is generally from one to 10 millimeters, but may be larger up to any specific governmental regulatory limitations in existence.

As used herein, the term "fastener" and variants thereof means a restraint capable of holding one constitutive element in place with respect to one or more other constitutive elements, coupling the elements together. Unless otherwise noted, a fastener may allow relative movement between the two or more elements coupled together, so long as the two or more elements are not able to move apart by more than 100% of their largest characteristic dimension. Non-limiting examples of fasteners include screws, bolts, staples, string, adhesives, epoxies, elastic materials, snaps, rivets, and tapes having a variety of different forms and/or shapes.

As used herein, the term "wheel" is taken to be a wheel that is attachable to a vehicle. "Wheel" and "vehicle wheel" are interchangeable.

The headings provided herein are for convenience only and do not interpret the scope or meaning of the embodiments.

Various embodiments of a wheel holder assembly are described herein, where the wheel holder assembly typically includes a wheel cover holder coupleable to a wheel, and a wheel cover selectably coupleable to and decoupleable from the wheel cover holder. In some embodiments, the wheel cover holder is selectively coupleable to and from the wheel.

Figure 1 shows an exemplary wheel cover holder 10 in relation to an exemplary vehicle wheel 180. Vehicle wheels are generally cylindrical in nature. The vehicle wheel 180 comprises a rim portion 181 that generally includes an inner edge facing the geometric center of the vehicle wheel 180

and/or an outer edge facing outward from the geometric center of the vehicle wheel 180. A tire 170 is generally mounted to the vehicle wheel 180.

The wheel cover holder 10 comprises a wheel snap-on mechanism 20 capable of being lockably mounted to a vehicle wheel, a bearing assembly 150 coupled to the wheel snap-on mechanism 20, and a holder plate 160 coupled to the bearing assembly 150. The bearing assembly 150 may include a ball bearing, tapered roller bearing, or other bearing capable of maintaining the holder plate 160 and a base mount 110 (called out in Figure 8) able to rotate freely with respect to one another. The holder plate 160 has a center of mass offset from the center of mass of the bearing assembly 150 when coupled thereto. The holder plate 160 is not otherwise limited or restricted to any particular shape or configuration, provided that it is capable of holding a wheel cover.

Various constitutive elements such as the wheel snap-on mechanism 20, the bearing assembly 150, and the holder plate 160 may be made using any suitable material. Although no specific limitations are placed on materials used, properties such as strength, resistance to deformation, fatigue resistance, workability, oxidation and reduction resistance, and cost may be taken into consideration when choosing appropriate materials.

Figure 2 shows the wheel cover 10 lockably mounted to the vehicle wheel 180.

Figure 3 shows an exploded view of the wheel snap-on mechanism 20. In one or more embodiments the wheel snap-on mechanism 20 comprises a spoke ring 30 including two or more spoke portions 32, a bearing assembly coupling portion 33, and a ring portion 34, an adjustment ring 40 (called out in Figures 1 and 4) rotatably slidably coupled to the spoke ring 30, and two or more engagement members 50 (called out in Figure 1) slidably coupled to the spoke ring 30. The engagement members 50 may alternatively be rotatably slidably coupled to the spoke ring 30.

The spoke ring 30 and the adjustment ring 40 are generally coupled together by one or more springs 60 (only one called out in Figure), as

shown in Figure 4. The spring 60 is shown as a helical or coil spring in Figure 4, but other types of springs capable of coupling the spoke ring 30 and the adjustment ring 40 may alternatively be used, for instance leaf springs.

The spoke ring 30 includes one or more spoke ring slots 35, and the adjustment ring 40 includes one or more adjustment ring slots 42. The spoke ring slots 35 are substantially located along radials from the geometric center of the spoke ring 30. The distance between the geometric center of the adjustment ring 40 and each of the one or more adjustment ring slots 42 varies along the length of the adjustment ring slots 42.

The spoke ring 30 and the adjustment ring 40 may be further coupled by using one or more fasteners each passing through one of the spoke ring slots 35 and one of the adjustment ring slots 42.

The spoke ring 30 may further comprise a spoke ring tab portion 31, and the adjustment ring 40 may further comprise an adjustment ring tab portion 41. Moving the spoke ring tab portion 31 and the adjustment ring tab portion 41 toward each other causes the spoke ring 30 to slide and rotate relative to the adjustment ring 40, and applies a force to each of the one or more springs 60. The spoke ring 30 and the adjustment ring 40 move from an initial state, where the force on each of the one or more springs 60 is substantially zero, to an engaging open state, where a non-zero force is present on each of the one or more springs 60. The springs 60 urge the spoke ring 30 and the adjustment ring 40 to return toward the initial state. Depending upon the orientation of the adjustment ring slots 42 and/or the location of the springs coupling the adjustment ring 40 and the spoke ring 30, each of the engagement members 50 may be located either closer to, or further from, the geometric center of the adjustment ring in the engaging open state relative to the initial state.

The engagement members 50 are slidably coupled to the spoke ring 30 by one or more fasteners 70 (only one called out in Figure 3) passing through the adjustment ring slots 42. When the spoke ring tab portion 31 and the adjustment ring tab portion 41 are moved toward each other as illustrated in

Figure 5A, each of the fasteners 70 are constrained to slide within one of the adjustment ring slots 42 and one of the spoke ring slots 35. Each of the fasteners 70 thus moves relatively toward or away from the geometric center of the adjustment ring 40 and the geometric center of the spoke ring 30. Each of the engagement members 50 coupled by the fasteners 70 thus also moves relatively toward or away from the geometric center of the adjustment ring 40 and the geometric center of the spoke ring 30.

Figure 5B shows an embodiment where three engagement members 50 are coupled to the spoke ring 20, and three springs 60 are employed. The three engagement members 50 are semicircular arc shape members, and substantially form a ring when coupled together. The left-hand side of Figure 5B shows an initial state or configuration where there is substantially zero force on the springs 60. The right-hand side of Figure 5B shows an engaging open state or configuration where the springs 60 have elongated due to relative movement of the spoke ring 30 and the adjustment ring 40. In the engaging open state or configuration, the engagement members 50 have moved toward the geometric center of the spoke ring 30 and the geometric center of the adjustment ring 40.

Moving the wheel snap-on mechanism 20 in the engaging open state or configuration to a position proximate the rim portion 181 of the wheel 180 and then lowering the force applied to the springs 60 by releasing the spoke ring tab portion 31 and the adjustment ring tab portion 41 allows the engagement members 50 to slide outward, away from the geometric center of the adjustment ring 40 and the geometric center of the spoke ring 30, engaging the inner side of the rim portion 181. The wheel cover holder 10 is thus lockably attached to the rim portion 181. The semicircular arc shape of the engagement members 50 may be advantageous in that the engagement members 50 will engage the inner side of the rim portion 181 over a substantial portion of the circumference thereof.

There are no specific limitations placed on the number of engagement members 50 employed provided that at least two are used. Two

or more of the engagement members 50 may be sufficient to lockably mount the wheel cover holder 10 to the wheel 180. However, using three or more engagement members 50 may be effective in providing a more secure mounting.

Figures 6A and 6B show an initial state or configuration and an engaging open state or configuration, respectively, for an embodiment where three disk shape engagement members 50 are employed. The engagement members 50 are capable of rotating with respect to the adjustment ring 40 and the spoke ring 30 while contacting the inner surface of the rim portion 181, allowing for smooth engagement between the engagement members 50 and the inner surface of the rim portion 181 when the adjustment ring tab portion 41 and the spoke ring tab portion 31 are released.

Figures 7A and 7B show an initial state or configuration and an engaging open state or configuration, respectively, for an embodiment where three hook shape engagement members 50 are employed. In contrast to the embodiments where the engagement members 50 are semicircular arc shape members or disk shape members, the engagement members 50 move outward, away from the center of the adjustment ring 40 when in the engaging open state. The engagement members 50 are capable of engaging the outside edge of the rim portion 181 when the spoke ring tab portion 31 and the adjustment ring tab portion 41 are released.

The two or more engagement members 50 are not limited in form or shape to a semicircular arc shape, a disk shape, or a hook shape. Other shapes capable of engaging the rim portion 181 of the vehicle wheel 180 may be used. In addition, the two or more engagement members 50 may employ different shapes. Disk shape and hook shape engagement members 50 may be used simultaneously on the wheel same snap-on mechanism 20, for example, providing engagement both at the inner surface and the outer surface of the rim portion 181.

Figure 8 shows another exemplary wheel cover holder 100 in relation to the exemplary vehicle wheel 180. Certain structures and operations

are similar to that of the embodiment shown in Figure 1, and are identified with common reference numerals. Only significant differences in structure and/or operation will be discussed, in the interest of brevity and clarity. The wheel cover holder 100 comprises a base mount 110 capable of being lockably mounted to a vehicle wheel, the bearing assembly 150 coupled to the base mount 110, and the holder plate 160 coupled to the bearing assembly 150.

Various constitutive elements such as the base mount 110, the bearing assembly 150, and the holder plate 160 may be made using any suitable material. Although no specific limitations are placed on materials used, properties such as strength, resistance to deformation, fatigue resistance, workability, oxidation and reduction resistance, and cost may be taken into consideration when choosing appropriate materials.

In one or more embodiments, the base mount 110 comprises: a base hub 120 including two or more arm portions 121 that extend outward from the geometric center of the base hub, toward the edge of a vehicle wheel when the wheel cover holder 100 is mounted thereto; a tightening lever 130 pivotably coupled to one or more of the arm portions 121 of the base hub 120 at a first coupling point 131; and an engagement arm 140 pivotably coupled to the tightening lever 130 at a second coupling point 132.

The engagement arm 140 comprises an end portion 141 having an engagement portion configured to physically engage the vehicle wheel 180 at the outer edge of the rim portion 181 when the engagement arm 140 is in a tensioned state or configuration. To facilitate engagement with the rim portion 181, the end portion 141 of the engagement arm 140 may be provided with a substantially flat shape, or a substantially hook shape, either or both of which may easily engage the rim portion 181 of the vehicle wheel 180 when the engagement arm 140 is tensioned.

No specific limitations are placed on the end portion 141 shape, and other shapes capable of physically engaging a specific outer edge shape of a given vehicle wheel may be suitably chosen. It may be preferable that the end portion 141 be given an overall shape designed to engage the outer edge

of a vehicle wheel over as large a surface area as possible in order to provide increased stability of engagement between the vehicle wheel 180 and the base mount 110.

Figure 9 shows the wheel cover holder 100 of Figure 8 mounted to the wheel 180 at the rim portion 181. Three arm portions 140 each having a respective end portion 141 are shown in Figure 8, but there are no specific limitations placed on the number of arm portions and accompanying end portions employed. Two or more of the arm portions 140 may be sufficient to lockably mount the wheel cover holder 100 to the wheel 180. However, using three or more arm portions 140 may be effective in providing a more secure mounting.

Figure 10 shows an exemplary coupling configuration between the base hub 120, the tightening lever 130, and the engagement arm 140 when in an unlocked state or configuration, where the wheel cover holder 100 is separated from the vehicle wheel 180. The base hub 120 and the tightening lever 130 may be freely pivoted about the coupling point 131, and the tightening lever 130 and the engagement arm 140 may be freely pivoted about the coupling point 132. It may be advantageous to place the coupling point 132 at a location away from one end of the tightening lever 130. This may allow the tightening lever to be more easily rotated manually.

Figure 11 shows the exemplary coupling configuration of Figure 10 when in a locked state or configuration, where the wheel cover holder 100 is mounted to the wheel 180 and the second coupling point 132 has been moved to a position closer to the geometric center O of the base hub 120 than the first coupling point 131. This generally results in the engagement arm 140, the tightening lever 130, and the base hub 120 being in a tensioned state or configuration.

Figure 12A shows a cross sectional view of the blown-up or enlarged portion of Figure 10 taken along section line A-A.

Figure 12B shows a cross sectional view of the blown-up or enlarged portion of Figure 11 taken along section line B-B. The base hub 120,

the tightening lever 130, and the engagement arm 140 are coupled in a position where a line L1 connecting the first coupling point 131 and the second coupling point 132 forms a substantially non-zero angle θ with a line L2 radiating outward from the geometric center of the base mount 110 along the arm portion.

The existence of the non-zero angle between L1 and L2 allows a locking state or configuration to exist when the base mount 110 is mounted to the wheel 180. With the end portion 141 of the engagement arm 140 touching the rim portion 181 of the wheel 180, the engagement arm 140 may tend to be tensioned according to its elastic modulus and the amount that the engagement arm 140 must deform elastically to reach the locked state or configuration. The greatest tensile force working on the engagement arm 140 would tend to exist when the first coupling point 131 and the second coupling point 132 form a single straight line with the geometric center O of the base hub 120, where the engagement arm 140 has a maximum elastic deformation. In the locked state or configuration, however, the existence of the non-zero angle θ suggests that the point of maximum elastic deformation, and hence the point of maximum tension, has been passed, tending to place the base mount 110 in a stable state or configuration, resistant to unintentional unlocking.

Figures 13A to 13D show side views of a portion of the base mount 110 (Figures 10 and 11) illustrating a series of states or configurations from open to locked. In Figure 13A the base mount 110 is open, and the engagement arm 140 is in a non-tensioned, non-elastically deformed state. In Figure 13B, the tightening lever 130 has been rotated or pivoted with respect to the engagement arm 140 by rotating the second coupling point about the first coupling point 131, causing the end portion 141 of the engagement arm 140 to contact the rim portion 181 of the wheel 180 and placing the engagement arm 140 in a tensioned state or configuration.

In Figure 13C, the tightening lever 130 has been rotated or pivoted further with respect to the engagement arm 140, increasing the tension in the engagement arm. Finally Figure 13D shows a locked state or configuration where the tightening lever 130 has been rotated or pivoted past

the point of maximum tension. The locked state or configuration is a stable state that requires a certain amount of force before the tightening lever 130 can be rotated or pivoted back toward the completely open state or configuration of Figure 13A.

Figure 14 shows an embodiment of the engagement arm 140 further comprising an optional hold bar 142 including a compress portion 143. The hold bar 142 is rotatably or pivotably coupled to the engagement arm 140 via a bracket 144. Rotating the hold bar 142 about a point 145 after the base mount 100 has been placed in a locked state or configuration attached to the wheel 180 causes the compress portion 143 to contact the rim portion 181 of the wheel 180 (Figures 8 and 9) on a side opposite that of the end portion 141. This contact may contribute to increasing the stability of the locked state or configuration.

Figure 15 shows another exemplary wheel cover holder 200 in relation to the exemplary vehicle wheel 180. Certain structures and operations are similar to that of the embodiment shown in Figure 1 and/or Figure 8, and are identified with common reference numerals. Only significant differences in structure and/or operation will be discussed, in the interest of brevity and clarity.

The wheel cover holder 200 comprises a base mount 210 capable of being mounted to a vehicle wheel 180, the bearing assembly 150 coupled to the base mount 210, and the holder plate 160 coupled to the bearing assembly 150.

The base mount 210 may be made using any suitable material. Although no specific limitations are placed on materials used, properties such as strength, resistance to deformation, fatigue resistance, workability, oxidation and reduction resistance, and cost may be taken into consideration when choosing appropriate materials.

The base mount 210 comprises: a base hub 220 including two or more arm portions 221 that extend outward from the geometric center of the base hub, toward the edge of a vehicle wheel when the wheel cover holder 200 is mounted thereto; a ratchet assembly 230 rotatably coupled to the base hub

220; and an engagement arm 240 slidably and rotatably coupled to the ratchet assembly.

The engagement arm 240 comprises an end portion 241 formed capable of engaging the vehicle wheel 180 at the outer edge of the rim portion 181 when the engagement arm 240 is in a tensioned state or configuration. To facilitate engagement with the rim portion 181, the end portion 241 of the engagement arm 240 may be provided with a substantially flat shape, or a substantially hook shape, either or both of which may easily engage the rim portion 181 of the vehicle wheel 180 when the engagement arm 140 is tensioned.

No specific limitations are placed on the end portion 241 shape, and other shapes capable of engaging a specific outer edge shape of a given vehicle wheel may be suitably chosen. It may be preferable that the end portion 241 be given an overall shape designed to engage the outer edge of a vehicle wheel over as large a surface area as possible in order to provide increased stability of engagement between the vehicle wheel 180 and the base mount 210.

Figure 16 shows the wheel cover holder 200 of Figure 15 mounted to the wheel 180 at the outer edge of the rim portion 181. Three arm portions 240 each having one end portion 241 are shown in Figure 16, but there are no specific limitations placed on the number of arm portions and accompanying end portions employed. Two or more of the arm portions 240 may be sufficient to lockably mount the wheel cover holder 200 to the wheel 180. However, using three or more arm portions 240 may be effective in providing a more secure mounting.

Figure 17A shows a coupling configuration between the base hub 220 and the ratchet assembly 230 when the wheel cover holder 200 is in an initial state or configuration. The ratchet assembly 230 comprises: a ratchet hub center member 231; a ratchet disk 232 coupled to the ratchet hub center member 231 and rotatably or pivotably coupled to the base hub 220; and one or more ratchet arms 235 (only one called out in the Figures) fixedly coupled to

the ratchet disk 232. The ratchet disk 232 has a substantially round annular plate shape including a regular jagged shape ratchet portion 233 on the outer circumference thereof.

A ratchet hook 234 may be rockably coupled to the base hub 220. The ratchet hook 234 may engage the ratchet assembly 230 at the regular jagged shape ratchet portion 233 as the ratchet arm 235 is used to rotate the ratchet disk 232 in the direction of arrow T in Figure 17A, helping prevent rotational movement of the ratchet disk 232 in a rotational direction opposite that of the arrow T.

One or more slots 237 may be opened in the ratchet disk 232, with the distance from the geometric center of the ratchet disk 232 to the slot differing along the longitudinal length of the slot 237, from a distance S1 to a distance S2. One or more fasteners may pass through the slot 237, slidably and rotatably coupling the ratchet assembly 230 to the engagement arm 240.

Rotating the ratchet assembly in the direction of the arrow T by moving the ratchet arm 235 causes the engagement arm to slide substantially radially along a line passing through the geometric center of the base hub, bringing the end portion 241 of the engagement arm 240 toward the geometric center of the base mount 210 and allowing the engagement arm 240 to engage the rim portion 181 of the wheel 180.

Figure 17B shows an intermediate state or configuration where the ratchet assembly has been rotated from the initial state or configuration of Figure 17A in the direction of the arrow T. The fastener 238 is now in an intermediate position along the slot 237, and the end portion 241 of the engagement arm 240 has moved closer to the geometric center of the base hub 220.

Figure 17C shows a locked state or configuration where the ratchet assembly has been rotated or pivoted further from the intermediate state or configuration of Figure 17B in the direction of the arrow T. The fastener 238 is now at one end of the slot 237, and the end portion 241 of the

engagement arm 240 has moved to a minimum distance from the geometric center of the base hub 220.

When the ratchet hook 234 is engaged with the ratchet portion 233, rotational movement of the ratchet assembly in a direction opposite the arrow T is substantially prevented. Rocking the ratchet hook 234 to disengage it from the ratchet portion 233 will allow the ratchet assembly to rotate in the direction of the arrow T.

An optional hold bar assembly similar to the hold bar 142 shown in Figure 6 may also be included in the wheel cover holder 200, rotationally coupled to the engagement arm 240, to provide further stability.

Figure 18 shows an exemplary wheel cover 300 capable of being coupled to the exemplary vehicle wheel 180 through use of a suitable wheel cover holder. The wheel cover 300 comprises a substantially dish shape member having a diameter D and a height H. The wheel cover 300 may be made using any suitable material. Considerations such as strength, resistance to deformation, fatigue resistance, workability, oxidation and reduction resistance, cost, and mass production suitability may be taken into consideration when choosing an appropriate material. The wheel cover 300 comprises one or more unitarily formed ridges 310 that protrude from the substantially dish shape member in a direction substantially orthogonal to directions of travel of the vehicle wheel 180 as the vehicle wheel 180 rotates while contacting the ground (*e.g.*, parallel to an axis of rotation of the vehicle wheel 180). The ridges 310 can provide the wheel cover 300 with added strength and resistance to bending, while allowing the wheel cover 300 to be made thinner over much of its surface, reducing material costs during manufacturing.

Forming the ridges 310 unitarily with the rest of the wheel cover 300 may eliminate the need for one or more separate strengthening members and fasteners for fastening the strengthening members to the wheel cover 300.

The one or more unitarily formed ridges 310 may take the form of a regular pattern shape. Areas of relatively high and low stress may tend to

develop over the face of the wheel cover 300 if the ridges 310 are formed haphazardly over the surface thereof. Using regular pattern shape ridges 310 can distribute stress on the wheel cover 300 more evenly over its surface.

Figure 19 shows the wheel cover 300 mounted on the vehicle wheel 180. A communication surface 301 of the wheel cover 300 serves as a base or foundation upon which to place an advertisement or other composition including photos, text, computer or manually drawn graphic, or any combination thereof. The advertisement or other composition may be drawn or printed directly on the communication surface 301 by using one or more dyes, pigments, paints, inks, or other drawing means, or may be otherwise deposited on the communication surface 301 and/or etched into the communication surface 301. When the communication surface 301 has a non-planar, three dimensional shape, automatic printing may be performed effectively by using a three dimensional printer, such as model HP Seitex FB6100 manufactured by Hewlett Packard.

The wheel cover 300 may sometimes benefit from including one or more unitarily formed posts 320 like that shown by Figure 20. The post 320 may be useful in coupling the wheel cover 300 to a stopper mechanism mounted to the vehicle wheel 180 and/or to a base mount such as the wheel snap-on mechanism 20, the base mount 110 or the base mount 210 described above. Forming the post 320 unitarily with the rest of the wheel cover 300 may eliminate the need for one or more separate connectors and fasteners for fastening the connectors to the wheel cover 300. The post 320 may include one or more openings 321 for accepting a coupling member intended to couple the wheel cover 300 to a stopper mechanism.

Removing a portion or otherwise creating a passage 330 of the wheel cover 300 as in Figure 21 may assist in equalizing air pressure on both sides of the wheel cover 300 by allowing greater airflow between the side having the ridges 310 and the side having the outer surface 301. Positioning the wheel cover on the vehicle wheel 180 so that the passage 330 faces away from the direction of travel of a vehicle to which the vehicle wheel 180 is

attached may also provide additional rotational stability to the wheel cover as the vehicle travels with the vehicle wheel rotating in contact with the ground.

The wheel over 300 may also include one or more unitarily formed control vanes 340 as shown in Figure 22. The control vanes 340 may assist in directing airflow toward the passage 330 as the vehicle travels with the vehicle wheel 180 rotating in contact with the ground.

A communication 350 may adhere to the communication surface 301, as shown in Figure 23. The communication 350 may be etched, printed, painted, glued, adhered or otherwise applied directly onto the communication surface 301. Alternatively, the communication 350 may be integrally embedded into or unitarily formed with the communication surface 301. The communication 350 may also take the form of a separate medium that is applied to the communication surface 301, such as a printed medium (*e.g.*, decal, placard or transfer). The communication 350 may be removable from the communication surface 301.

Adhesive means such as glue, paste, mastic, rubber cement, tape, epoxy, gum, or similar substance and/or element capable of achieving a sufficient molecular force between the communication 350 and the communication surface 380 may be used to apply the communication 350 thereto.

The communication 350 may comprise a thin curvilinear medium 380, as in Figure 24, substantially conforming to the communication surface 301 when applied. The communication 350 may initially be formed as a planar member, and encouraged to conform to the communication surface 301 by using heat, force, or other means during application.

The communication 350 may also comprise a plurality of distinct portions that are assembled together. Figure 25 shows the thin curvilinear portion 380 that may substantially cover the communication surface, for example, and a three dimensional portion 381 that may be coupled to the thin curvilinear portion 380 using adhesive means. The three dimensional portion may take the form of a substantially solid material such as a plastic or foam, or

a blister (*e.g.*, Mylar®) covering capable of contacting the thin curvilinear portion 380 over a substantially non-zero surface area. The blister covering form may be advantageous in limiting the mass of the three dimensional portion 381, as well as in reducing material costs. An optional foot contact area 382 provides a substantially non-zero surface area over which the three dimensional portion 381 may be coupled to the thin curvilinear portion 380.

Alternatively, the thin curvilinear portion 380 may be formed having an open portion 383 as in Figure 26, and the three dimensional portion 382 may be attached directly to the communication surface 301 at the open portion 383.

Figure 27 shows that the three dimensional portion 381 may also be attached to the communication surface 301 alone, without being used in conjunction with the curvilinear portion 380.

The curvilinear portion 380 and the three dimensional portion 381 may each be used independently of the other, and each may range from a small size capable of being visible by a viewer as a vehicle passes by, to a large size substantially covering the communication surface 301.

Figures 28, 29A and 29B show another exemplary wheel cover holder 400 in relation to the exemplary vehicle wheel 180 and an exemplary wheel cover 450. The wheel cover holder 400 comprises a base mount 410 lockably attachable to a vehicle wheel, the bearing assembly 150 coupled to the base mount 410, a holder plate 430 coupled to the bearing assembly 150, the center of mass of the holder plate offset from the center of mass of the bearing assembly 150, and a snap-in-place mechanism 420 as a stopper mechanism coupled to the holder plate 430.

Various constitutive elements such as the base mount 410, the snap-in-place mechanism 420, the holder plate 430, and the wheel cover 450 may be made using any suitable material. Although no specific limitations are placed on materials used, properties such as strength, resistance to deformation, fatigue resistance, workability, oxidation and reduction resistance, and cost may be taken into consideration when choosing appropriate materials.

In one or more embodiments the snap-in-place mechanism 420 comprises two engaging rings 421 and one or more springs 422 coupling the two engaging rings 421. Each of the engaging rings 421 may comprise an engaging clamp portion 423 (called out in Figures 29A and 29B) and one or more lever portions 424.

Arranging the two engaging rings 421 back to back at a non-zero angular offset before coupling using the one or more springs 422 disposes the engaging clamp portions 423 on the two engaging rings 421 at an angular offset, and disposes the lever portions 424 on the two engaging rings 421 at an angular offset.

The angular offset may be set to place at least one of the engaging clamp portions 423 on one of the two engaging rings 421 proximate to at least one of the engaging clamp portions or opposable jaws 423 on the other of the two engaging rings 421 with a non-zero space therebetween. The non-zero space may be used to lockably couple the snap-in-place mechanism to a wheel cover.

Figure 30 shows the wheel cover 450 comprising one or more unitarily formed posts 451 including an engaging groove portion 452. The width of the post at the engaging groove portion 452 of the post 451 is shown as Dp.

Moving at least one lever portion 424 on one of the two engaging rings 421 toward at least one lever portion 424 on the other of the two engaging rings 421 causes a force to be applied to the one or more springs 422, and causes the two engaging rings to slidably rotate with respect to each other, resulting in an open state.

Figure 29A shows an initial state where substantially no force is acting on the spring 422, and the open state after the two engaging rings 421 have been slidably rotated with respect to one another. Figure 29B is similar to Figure 29, shown from a plan view orientation. The distance between corresponding engaging clamp portions 423 changes from Di in the initial state to Do in the open state or configuration. For the two engaging clamp portions 423 to work as a clamp for lockably engaging the post 441 the following

conditions should be met: the distance Do in the open state must be greater than the width Dp of the engaging groove portion of the post 451, and the distance Di in the initial state must be less than the width Dp. A reference angle α in Figure 29B shows the relative angular movement between the two engaging rings 421.

Moving the wheel cover 450 to a location proximate to the stopper mechanism 420 with the engaging clamp portions 423 in the open state, and then lowering the force applied to the one or more springs 422 by releasing the lever portions 424 with the groove portion 452 of the post 451 positioned between the engaging clamp portions 423 causes the engaging clamp portions 423 to engage the post 451 at the groove portion 452. Since the initial state distance Di is less than the width Dp, force will remain in the one or more springs 422, which will urge the engaging clamp portions 423 to continue to engage the post 451 in a locked state.

Figure 31 shows another exemplary wheel cover holder 500 in relation to the exemplary vehicle wheel 180 and an exemplary wheel cover 550. The wheel cover holder 500 comprises the base mount 410 lockably attachable to a vehicle wheel, the bearing assembly 150 coupled to the base mount 410, the holder plate 430 coupled to the bearing assembly 150, the center of mass of the holder plate offset from the center of mass of the bearing assembly 150, a stopper mechanism 520 coupled to the holder plate 430.

Various constitutive elements such as the base mount wheel cover 550 and the stopper mechanism 520 may be made using any suitable material. Although no specific limitations are placed on materials used, properties such as strength, resistance to deformation, fatigue resistance, workability, oxidation and reduction resistance, and cost may be taken into consideration when choosing appropriate materials.

As best seen in Figure 32, in one or more embodiments the stopper mechanism 520 comprises a stopper ring 521, a stopper link 522 rotatably slidably coupled to the stopper ring 521, and at least two engaging links 523 rotatably slidably coupled to the stopper ring.

The stopper mechanism 520 is capable of transforming substantially linear motion in one direction into radial motion in a plurality of directions substantially along radials from the geometric center of the stopper ring 521.

Figure 33A shows the stopper mechanism 520 in an open state or configuration and Figure 33B shows the stopper mechanism in a locked state or configuration. The engaging links 523 each comprise an end portion 525 that may be preferably tapered. A slot 524 opened in each of the engaging links 523 allows the engaging links 523 to slide relative to the holder plate 430, substantially along radial directions from the geometric center of the stopper ring 521.

A slot 526 is opened in the stopper link 522, and a fastener 527 passes through the slot 526, coupling the stopper link 522 and the holder plate 430. The slot 526 may preferably be formed in a hook shape or other shape substantially following at least two different linear directions.

When the stopper link 522 is moved relative to the holder plate 430, constrained by the coupling through the slot 527, the end portions 525 of the engaging links 523 move substantially along radials from the stopper ring 521. Figure 33A shows the open state where the end portions 525 of the engaging links 523 are located at a minimum distance from the center of the stopper ring 521. In the locked state or configuration of Figure 33B, the end portions 525 are located substantially at a maximum distance from the center of the stopper ring 521.

Figure 34 shows the exemplary wheel cover 550 suitable for use in conjunction with the wheel cover holder 500. The wheel cover 550 comprises two or more posts 552 each having a hole 551 opened therein. The holes are capable of accepting the end portions 525 of the engaging links 523 when the stopper mechanism 520 is in the locked state. The posts protrude sufficiently to be readily visible to a user installing the wheel cover 550 onto the wheel cover holder 500 via the stopper mechanism 520.

Figure 35 shows a close-up view of the slot 526 and the fastener 527 as the stopper mechanism 520 is moved from the open state or configuration to the locked state or configuration. The stopper link 522 is first moved in a first direction D1 and then in second direction D2. The slot 526 may be designed so that the stopper link 522 can be further moved back in a direction opposite the direction D1, stabilizing the locked state or configuration.

Figure 36 shows a close-up view of the slot 526 and the fastener 527 as the stopper link 522 is moved along a hook-shaped path, initially in the first direction D1, moving the stopper mechanism 520 from the open state or configuration to the locked state or configuration.

To further stabilize the locked state or configuration, the hold bar 430 may further comprise a locking projection 431 as shown in Figure 37, and a hole 529 may be opened in the stopper link 522 (refer to Figure 33A.) The hole 529 and the projection 431 are positioned so that the hole 529 accepts the projection 431 when the stopper link 522 has been moved to place the stopper mechanism 520 in the locked state. Figure 38 shows the locking projection 431 on the hold bar 431.

In an alternative embodiment, rotating structure may be used to substitute for the stopper link 522 when rotating the stopper ring 521, causing the engaging links 523 to move substantially along radials from the geometric center of the stopper ring 521. The rotating structure may be integrated into the stopper mechanism 520, or may be removably attachable to the stopper mechanism 520. The rotating structures include manual devices, structures, and mechanisms such as a ratchet, locking rotator, or turntable, and may employ a ratchet mechanism to ensure motion in only one direction. The rotating structure may also include automated devices, engines, motors, and the like employing an electric power source, elastic power source, or combustible power source. The automated devices may be manually, electronically, or physically controlled.

Figure 39A shows a portion 600 of a base mount of an exemplary wheel cover holder. The base mount 20 described above may typically be used,

but the base mount may take other forms as well. The base mount has a center hole 601 located substantially at a center of mass of the base mount. The center hole 601 is sized and configured to accept a fastener 610. The base mount 20 may be coupled to the bearing assembly 150 (previously illustrated), for example, by the fastener 610. Accurate centering of the fastener 610 when tightened may be preferable in order to allow a wheel cover holder employing the base mount to rotate substantially about its center without wobble.

A first inner sidewall portion 602 and a second inner sidewall portion 603 may be adjacent to or define the center hole 601. The second inner sidewall portion 603 forms a first taper angle α with the first inner sidewall portion 602, as best illustrated in Figure 39B. The angle α differs substantially from 180 degrees, and may be obtuse.

The fastener 610 comprises a head portion 611 having a head taper sidewall 613 and a body or longitudinal sidewall 612 substantially parallel to the longitudinal axis of the fastener 610. The body or longitudinal sidewall 612 forms a second taper angle β with the head taper sidewall 613, as in Figure 39B.

Setting the first taper angle α to be larger than the second taper angle β ensures that the fastener 610 will contact the second inner sidewall portion 603 along a minimum surface area substantially corresponding to a thin annular ring, and ensuring automatic centering where the first inner sidewall portion 602 remains substantially parallel to the longitudinal axis of the fastener. This promotes rotation of a wheel cover holder employing the base mount, without wobble.

Figure 40 shows a wheel cover assembly according to another illustrated embodiment, including a wheel cover holder 700 attached to a wheel cover 750. The wheel cover holder 700 comprises a base mount 710 lockably attachable to a vehicle wheel, a bearing assembly 720 coupled to the base mount 710, a holder plate 730 coupled to the bearing assembly 720, a center of

mass of the holder plate 730 offset from a center of mass of the bearing assembly 710, and the wheel cover 750 attached to the holder plate 730.

Figure 41 shows the holder plate 730. The holder plate 730 may comprise a center portion 731 coupled to the bearing assembly 720, at least three arms (collectively 732) extending from the center portion 731, an arciform coupling member 733 that couples at least two of the at least three arms 732, and a stopper lever 740 extending from the center portion 731. An optional locking portion 741 may be coupled to an end portion of the stopper lever 740 distal to the center portion 731.

Locating the arciform coupling member 733 away from the geometric center of the bearing assembly 720 allows the center of mass of the holder plate 730 to be offset from the geometric center of the bearing assembly 720, inhibiting rotation of the holder plate 730.

The stopper lever 740 may take a variety of forms depending upon the size of a vehicle wheel to which the wheel cover holder 700 is mounted. Figures 42A, 42B, and 42C show different embodiments of one or more through holes 742 through which the holder plate 730 is coupled. The holder plate 730 may be employed for vehicle wheels having a variety of sizes using different sized wheel covers. The stopper lever 740 is used when locking a wheel cover to the holder plate 730. Designing the stopper lever 740 to have a variety of through holes 742 allows the end portion of the stopper lever 740 and the optional locking portion 741 to be employed with different sized vehicle wheels and/or different sized wheel covers while being accessible at a position near the outermost edge of the wheel cover.

The various embodiments described above can be combined to provide further embodiments. All of the U.S. patents, U.S. patent application publications, U.S. patent applications, foreign patents, foreign patent applications and non-patent publications referred to in this specification are incorporated herein by reference, in their entirety.

Aspects of the various embodiments can be modified, if necessary, to employ devices, apparatuses, and concepts of the various

patents, applications and publications to provide yet further embodiments, including those patents and applications identified herein.

These and other changes can be made in light of the above-detailed description. In general, in the following claims, the terms used should not be construed to be limiting to the specific embodiments disclosed in the specification and the claims, but should be construed to include all systems, devices and/or methods that operate in accordance with the claims. Accordingly, the invention is not limited by the disclosure, but instead its scope is to be determined entirely by the following claims.

CLAIMS

We/I claim:

1. A wheel cover assembly capable of being mounted to, and removed from, a wheel having a rim portion, without loosening any fasteners attaching the wheel to a vehicle, the wheel cover assembly comprising:

a wheel cover holder including:

a base mount lockably attachable to the rim portion of the wheel;

a bearing assembly physically coupled to the base mount and having a center of mass;

a holder plate physically coupled to the bearing assembly and having a center of mass, the center of mass of the holder plate offset from the center of mass of the bearing assembly; and

a stopper mechanism physically coupled to the holder plate, the stopper mechanism lockably attachable to a wheel cover.

2. The wheel cover assembly according to claim 1, further comprising a wheel cover selectively mountable to and dismountable from the wheel cover holder without the use of tools.

3. The wheel cover assembly according to claim 1, wherein the base mount comprises a wheel snap-on mechanism comprising:

a spoke ring physically coupled to the bearing mechanism, the spoke ring comprising a ring portion, a bearing assembly coupling portion, and at least two spoke portions that physically couple the ring portion with the hub center portion;

an adjustment ring rotatably slidably coupled to the spoke ring; and

at least two engagement members slidably coupled to the spoke ring, the engagement members configured to engage at least part of the rim portion.

4. The wheel cover assembly according to claim 3, wherein the engagement members are rotatably slidably coupled to the spoke ring.

5. The wheel cover assembly according to claim 3 or claim 4, further comprising at least one spring that biasingly couples the spoke ring and the adjustment ring.

6. The wheel cover assembly according to claim 5, wherein the spoke ring further comprises a spoke ring tab portion, and the adjustment ring comprises an adjustment ring tab portion.

7. The wheel cover assembly according to claim 6, wherein the adjustment ring includes at least one adjustment ring slot and the spoke ring includes at least one spoke ring slot, and a distance between a geometric center of the adjustment ring and the at least one adjustment ring slot varies along a length of the at least one adjustment ring slot; and further comprising at least one fastener that rotatably and slidably couples the spoke ring and the adjustment ring together, the at least one fastener passing through a respective one of the at least one adjustment ring slot and the at least one spoke ring slots.

8. The wheel cover assembly according to claim 7, wherein when the spoke ring tab portion and the adjustment ring tab portion are manually moved relatively toward one another, a force applied to the at least one spring tends to cause the adjustment ring to rotatably slide relative to the spoke ring along the one or more radial spoke ring slots and the one or more adjustment ring slots, and tends to cause the two or more engagement

members to slide relative to the spoke ring and the adjustment ring, moving from initial locations to engaging open locations.

9. The wheel cover assembly according to claim 8, wherein when the snap-on mechanism is moved proximate the rim portion and then a force applied to the at least one spring is lessened by releasing the spoke ring tab portion and the adjustment ring tab portion the at least two engagement members slide relative to the spoke ring and the adjustment ring, moving from the engaging open locations toward, but not completely to, the initial locations, lockably attaching the wheel cover holder to the rim portion as the at least two engagement members engage at least part of the rim portion.

10. The wheel cover assembly according to claim 1, wherein the base mount comprises:

a base hub including at least two arm portions that extend toward an outer edge of the rim portion when the wheel cover holder is mounted to the wheel;

a tightening lever rotatably coupled to at least one of the arm portions of the base hub at a first coupling point; and

an engagement arm rotatably coupled to the tightening lever at a second coupling point, the engagement arm comprising an end portion configured to engage an outer edge of the rim portion when the engagement arm is in a tensioned state.

11. The wheel cover assembly according to claim 10, wherein a line connecting the first coupling point and the second coupling point forms an angle with a line radiating outward from a geometric center of the base mount along the arm portion to which the tightening lever is coupled, the angle differing substantially from zero degrees.

12. The wheel cover assembly according to claim 11, wherein moving the second coupling point to a location closer to a geometric center of the base hub tends to lockably couple the wheel cover holder to the wheel as the end portion of the engagement arm physically engages at least part of the outer edge of the rim portion.

13. The wheel cover assembly according to claim 1, wherein the base mount comprises:

a base hub including at least two arm portions that extend toward an outer edge of the rim portion when the wheel cover holder is mounted to the wheel;

a ratchet assembly rotatably coupled to the base hub; and

an engagement arm rotatably slidably coupled to the ratchet assembly at a first coupling point, the engagement arm comprising an end portion configured to engage at least part of the outer edge of the rim portion when the engagement arm is in a tensioned state.

14. The wheel cover assembly according to claim 13, further comprising a ratchet hook rockably coupled to the base hub, wherein the ratchet assembly comprises: a ratchet hub center member; a ratchet disk rotatably coupled to the base hub, the ratchet disk having a substantially round annular plate shape including a regular jagged shape ratchet portion on the outer circumference of the ratchet disk; and at least one arm fixedly coupled to the ratchet disk.

15. The wheel cover assembly according to claim 14, wherein the ratchet disk includes at least one slot, the distance from a geometric center of the ratchet disk to the slot differing along a length of the slot, and wherein at least one fastener passes through the at least one slot, the at least one fastener rotatably coupling the base hub to the ratchet assembly and slidably rotatably coupling the ratchet assembly to the engagement arm.

16. The wheel cover assembly according to claim 15, wherein rotating the ratchet assembly in a first rotational direction via the lever arm causes the engagement arm to slide substantially along a radial line passing through a geometric center of the base hub, tending to lockably couple the wheel cover holder to the wheel as the end portion of the engagement arm engages at least part of the outer edge of the rim portion.

17. The wheel cover assembly according to claim 16, wherein the ratchet hook engages with the jagged portion of the ratchet disk, tending to prevent the ratchet disk from rotating in a second rotational direction opposite the first rotational direction.

18. The wheel cover assembly according to claim 12 or claim 17, wherein the end portion of the engagement arm has a substantially flat plane shape.

19. The wheel cover assembly according to claim 12 or claim 17, wherein the end portion of the engagement arm has a substantially hook shape.

20. The wheel cover assembly according to claim 12 or claim 17, the base mount further comprising a hold bar rotatably coupled to the engagement arm, wherein rotating the hold bar causes a portion of the hold bar to engage at least part of an inner edge of the rim portion.

21. A wheel cover assembly which permits a wheel cover to be fixedly attached to, and detached to a wheel, manually, without the use of external tools, the wheel cover assembly comprising:

a wheel cover holder, including:

a base mount lockably attachable to a wheel;

a bearing assembly coupled to the base mount;

a holder plate coupled to the bearing assembly, the center of mass of the holder plate offset from the center of mass of the bearing assembly; and

a stopper mechanism coupled to the holder plate, the stopper mechanism lockably attachable to a wheel cover.

22. The wheel cover assembly according to claim 21, wherein the stopper mechanism is a snap-in-place mechanism comprising:

two engaging rings; and

a spring that slidably rotatably couples the two engaging rings together.

23. The wheel cover assembly according to claim 22 wherein each of the two engaging rings comprises at least one engaging clamp portions and at least one portions.

24. The wheel cover assembly according to claim 23, wherein the two engaging rings are arranged back to back, at a non-zero angular offset.

25. The wheel cover assembly according to claim 24, wherein at least one engaging clamp portion on one of the two engaging rings is proximate at least one engaging clamp portion on the other of the two engaging rings, a non-zero space therebetween.

26. The wheel cover assembly according to claim 25, wherein when a force is applied to the spring by movement of at least one lever on one of the two engaging rings toward at least one lever on the other of the two engaging rings, the two engaging rings rotatably slide with respect to each other, and causes the non-zero space to become larger.

27. The wheel cover assembly according to claim 26, further comprising a wheel cover, having a post with an engaging groove portion having a lateral dimension larger than the non-zero space, wherein movement of the wheel cover to a location proximate to the snap-in-place mechanism, and then a reduction of a force applied to the spring by a release of at least one lever on both of the two engaging rings, causes the non-zero space to become smaller until the at least one engaging clamp portion on one of the two engaging rings and the at least one engaging clamp portion on the other of the two engaging rings to lockably attach to the post.

28. The wheel cover assembly according to claim 21, wherein the stopper mechanism comprises:

a stopper ring;

a stopper link rotatably slidably coupled to the stopper ring; and

at least two engaging links rotatably slidably coupled to the stopper ring.

29. The wheel cover assembly according to claim 28, further comprising a wheel cover, the wheel cover comprising at least two posts, each of the posts having at least one respective a hole, where the posts are oriented substantially parallel to an axis of rotation of the vehicle wheel when the wheel cover is mounted to the vehicle wheel.

30. The wheel cover assembly according to claim 21, wherein the stopper mechanism comprises:

a stopper ring;

rotating means for rotating the stopper ring, the rotating means coupled to the stopper ring; and

at least two engaging links rotatably slidably coupled to the stopper ring.

31. The wheel cover assembly according to claim 30, further comprising a wheel cover, the wheel cover comprising at least two posts, each of the posts having a respective hole, where the posts are oriented substantially parallel to an axis of rotation of the vehicle wheel when the wheel cover is mounted to the vehicle wheel.

32. The wheel cover assembly according to claim 29 or claim 31, wherein the posts are located in positions readily visible to a user installing the wheel cover onto the wheel cover holder.

33. The wheel cover assembly according to claim 29, wherein end portions of each of the at least two engaging links are slidably engagable with at least one of the posts via the hole in the posts when the stopper link is slidably moved in a first direction substantially toward a geometric center of the stopper mechanism.

34. The wheel cover assembly according to claim 29, wherein end portions of each of the at least two engaging links are lockably slidably engagable with at least one of the posts via the hole in the posts when the stopper link is slidably moved along a substantially hook shape path, initially in a first direction substantially toward a geometric center of the stopper mechanism.

35 The wheel cover assembly according to claim 34, wherein the hook shape path corresponds to a guide path opened in the stopper link.

36. The wheel cover assembly according to claim 33 or claim 34, wherein the holder plate comprises a locking projection, and the locking projection protrudes into a hole opened in the stopper link when the stopper link is displaced in a second direction, substantially differing from the first direction,

once the at least two engaging links have each slidably engaged at least one of the posts.

37. The wheel cover assembly according to claim 31, wherein a respective end portion of each of the at least two engaging links are slidably engagable with at least one of the posts when the rotating means is manually rotated.

38. The wheel cover assembly according to claim 37, wherein a respective end portion of each of the at least two engaging links are lockably slidably engagable with at least one of the posts after the rotating means has been rotated to a rotation limit point.

39. A wheel cover capable of being coupled to a vehicle wheel through use of a suitable wheel cover holder, the wheel cover comprising:

a substantially dish shape member having a diameter, a depth, and at least one communication surface capable of bearing a communication;

at least one ridge that protrudes from the dish shape member substantially parallel to an axis of rotation of the vehicle wheel, where the dish shaped member and the at least one ridge are a unitary structure; and

at least one post that protrudes from the dish shape member substantially parallel to the axis of rotation of the vehicle wheel, where the dish shaped member and the at least one post are a unitary structure.

40. The wheel cover according to claim 39, wherein the at least one ridge is present in a regular pattern shape.

41. The wheel cover according to claim 40, wherein the at least one post includes a hole.

42. The wheel cover according to claim 40, wherein the at last post includes an engaging groove portion.

43. The wheel cover according to any one of claims 39 to 42, wherein the dish shape member includes a passage.

44. The wheel cover according to claim 43, further comprising at least one control vane that protrudes from the dish shape member in a direction substantially parallel with the axis of rotation of the vehicle wheel, where the dish shaped member and the at least one control vane are a unitary structure.

45. The wheel cover according to claim 39, further comprising a visible communication disposed on the communication surface.

46. The wheel cover according to claim 45, wherein the communication is a three-dimensional communication.

47. The wheel cover according to claim 45 or claim 46, wherein the communication is selectively removable from the communication surface.

48. The wheel cover according to claim 39, wherein the communication comprises a thin curvilinear portion substantially covering the communication surface, and a three dimensional portion that protrudes from the communication surface at least in a direction orthogonal to a direction of travel of the vehicle wheel as the vehicle wheel rotates while in contact with a portion of ground.

49. The wheel cover according to claim 48, wherein the three dimensional portion comprises a blister covering capable of contacting the thin curvilinear portion over a substantially non-zero surface area.

50. The wheel cover according to claim 48 or claim 49, wherein the three dimensional portion is adhered to the communication surface using an adhesive.

51. A wheel cover holder comprising:

a base mount lockably attachable to a vehicle wheel, the base mount having a base mount center hole capable of accepting a fastener with a longitudinal axis, the base mount comprising a first inner sidewall portion and a second inner sidewall portion each adjacent to the base mount center hole;

a bearing assembly coupled to the base mount;

a holder plate coupled to the bearing assembly, the center of mass of the holder plate offset from the center of mass of the bearing assembly; and

a stopper mechanism coupled to the holder plate, the stopper mechanism lockably attachable to a wheel cover.

52. The wheel cover holder according to claim 51, wherein the first inner sidewall portion is substantially parallel to the longitudinal axis of the fastener, and the second inner sidewall portion forms a first taper angle with respect to the first sidewall portion, the angle differing substantially from 180 degrees.

53. The wheel cover holder according to claim 52, wherein the fastener comprises an external threaded portion, and the fastener couples the base mount to the bearing assembly.

54. The wheel cover holder according to claim 53, wherein the fastener comprises a head portion having a second taper angle with respect to the longitudinal axis of the fastener.

55. The wheel cover holder according to claim 54, wherein the first taper angle differs substantially from the second taper angle.

56. The wheel cover holder according to claim 54, wherein the first taper angle is greater than the second taper angle.

57. An engagement device configured to engage a member, the engagement device transforming rotational motion about a point into substantially linear motion along a plurality of radials originating substantially at the point, the engagement device comprising:

a base having at least two slots;

at least two engaging links slidably coupled to the base by at least one fastener via the at least two slots;

a rotatable ring capable of rotating about an axis through a geometric center thereof, the at least two engaging links rockably coupled to the rotatable ring;

wherein the at least two engaging links are adapted to be placed in engagable relation to the member.

58. An engagement device to engage a member, the engagement device transforming rotational motion about a point into substantially linear motion along a plurality of radials originating substantially at the point, the engagement device comprising:

a base;

at least two engaging links each having a slot, each of the at least two engaging links slidably coupled to the base by at least one fastener via said slot;

a rotatable ring capable of rotating about an axis through a geometric center thereof, the at least two engaging links rockably coupled to the rotatable ring;

wherein the at least two engaging links are adapted to be placed in engagable relation to the member.

59. The engagement device according to claim 57 or claim 58, wherein end portions of each of the at least two engaging links are slidably engagable with at least one of a plurality of holes in the member when the ring is rotated.

60. The engagement device according to claim 57 or claim 58, wherein end portions of each of the at least two engaging links are lockably slidably engagable with at least one of a plurality of holes in the member when the ring is rotated.

61. The engagement device according to claim 57 or claim 58, further comprising rotating means for rotating the ring.

62. A wheel cover holder comprising:

a base mount lockably attachable to a vehicle wheel;

a bearing assembly coupled to the base mount;

a holder plate coupled to the bearing assembly, the center of mass of the holder plate offset from the center of mass of the bearing assembly, the holder plate comprising:

an arm portion center coupled to the bearing assembly;

at least three arms extending from the arm center portion; and

an arciform coupling member that couples at least two of the at least three arms; and

a stopper lever; and

a wheel cover.

63. The wheel cover holder according to claim 62, where a plurality of holes are formed in the stopper lever.

64. The wheel cover holder according to claim 63, further comprising a spacer interposed between the base mount and the bearing assembly.

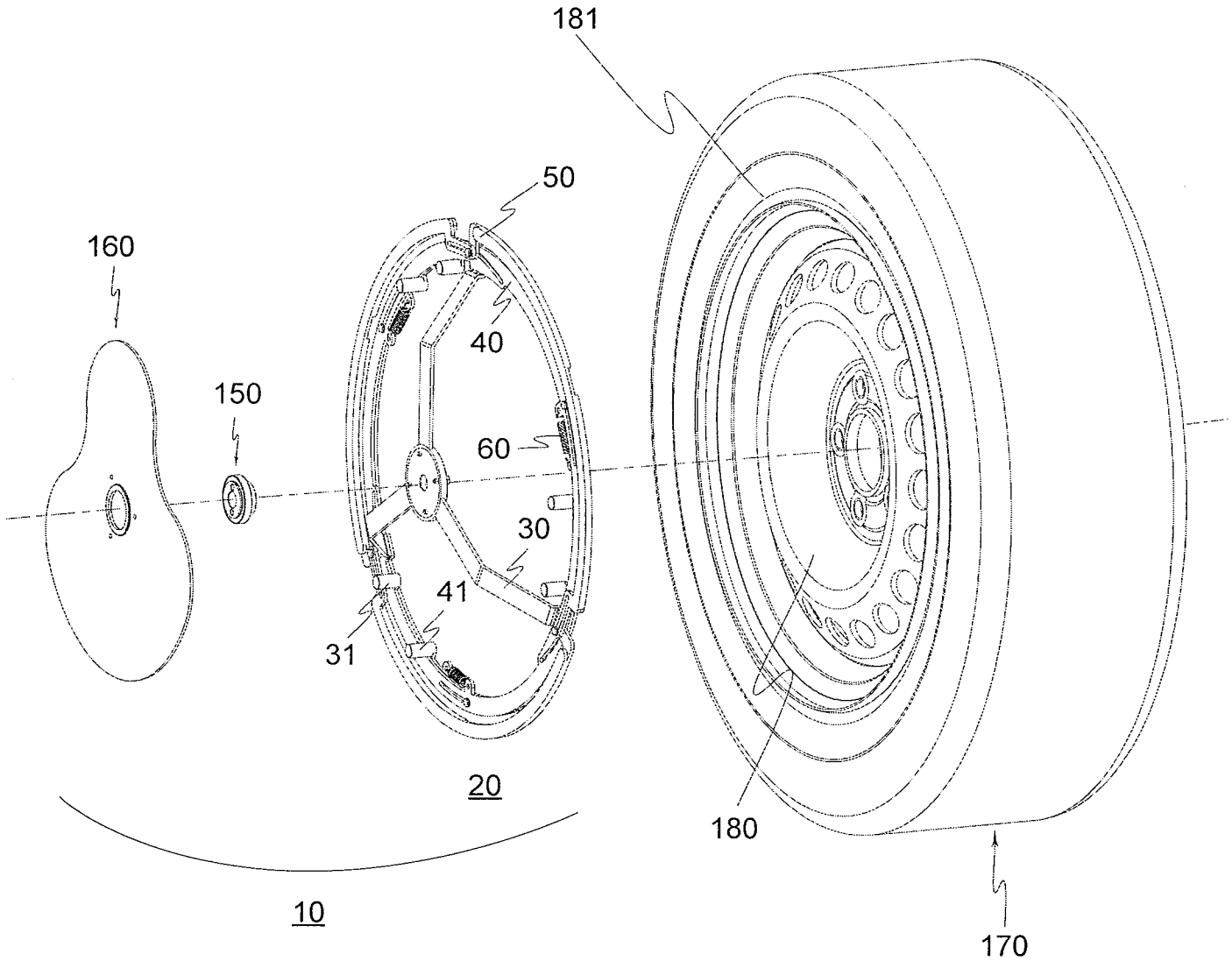


FIG. 1

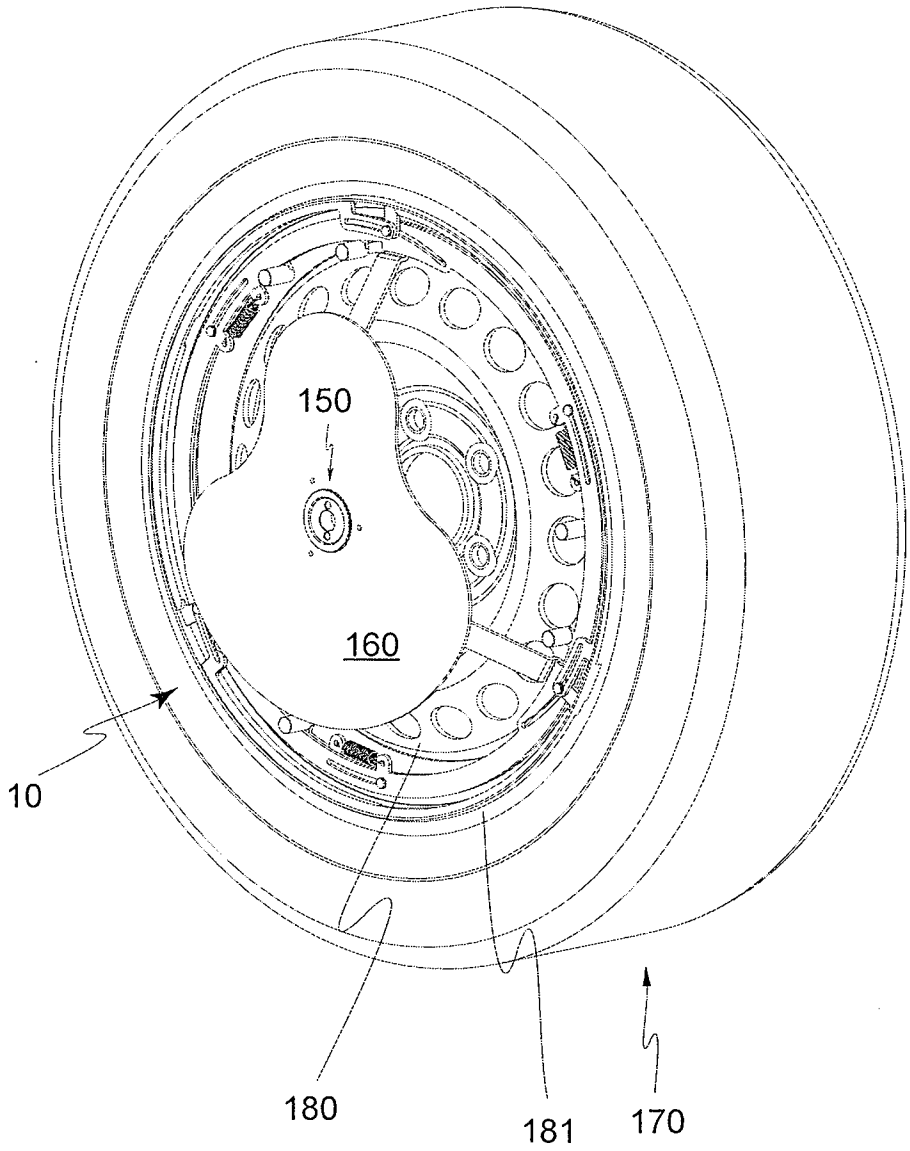


FIG. 2

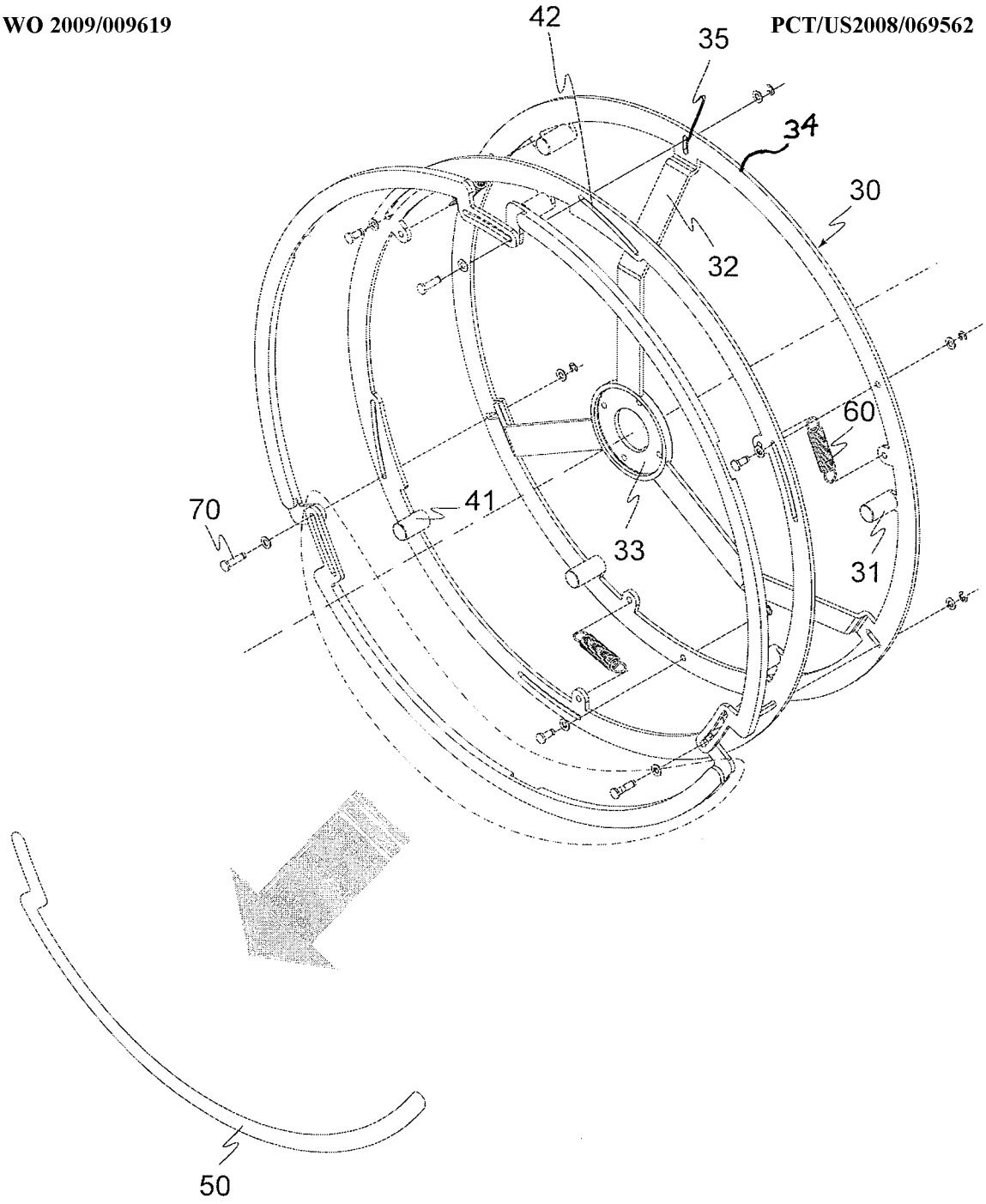


FIG. 3

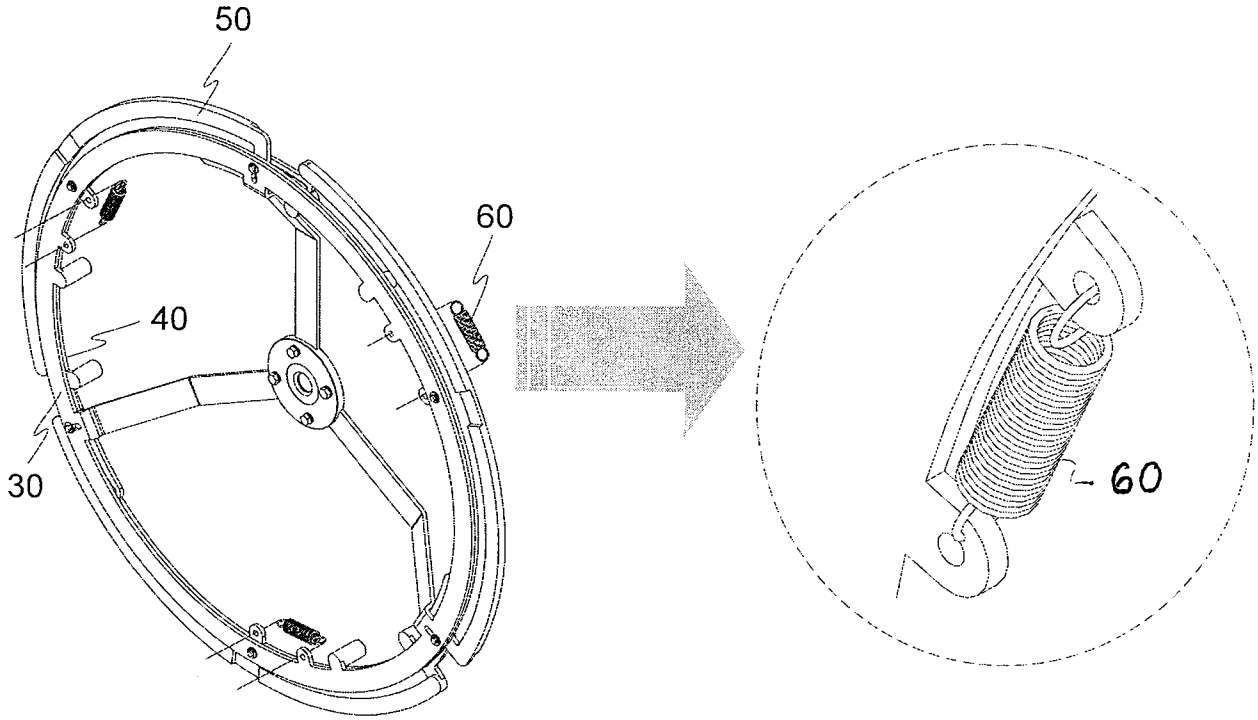


FIG. 4

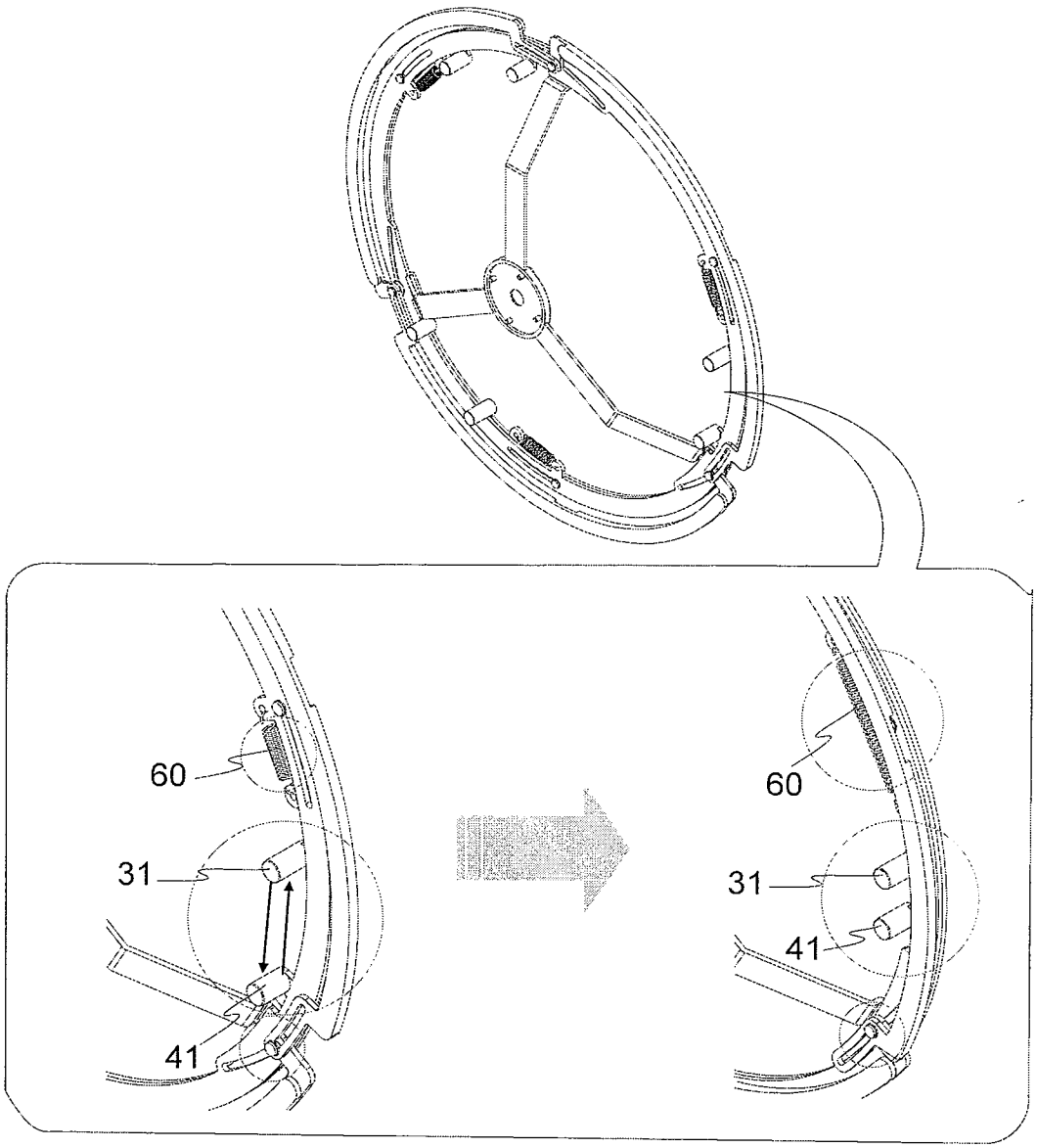


FIG. 5A

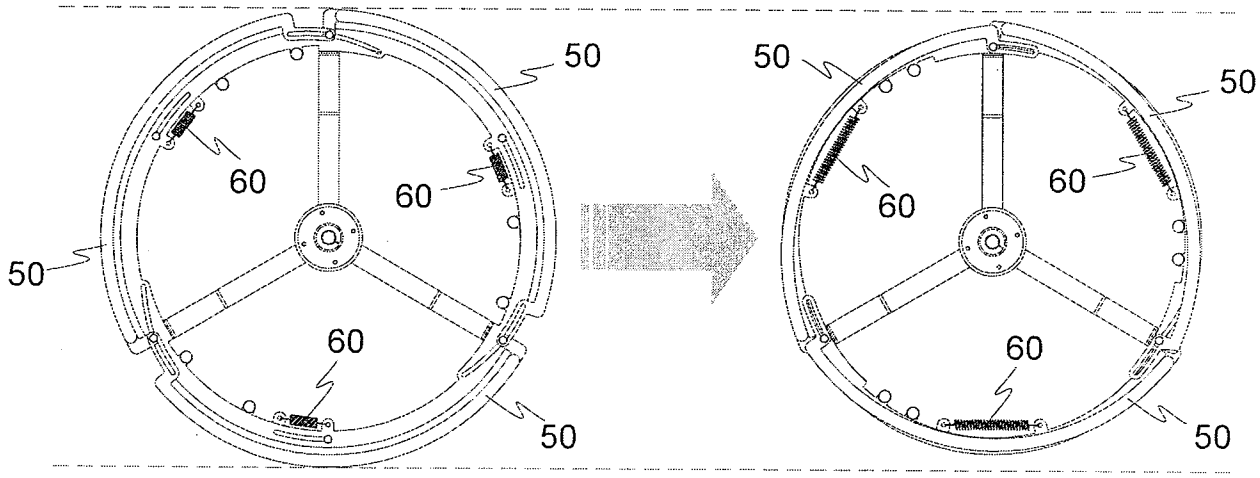


FIG. 5B

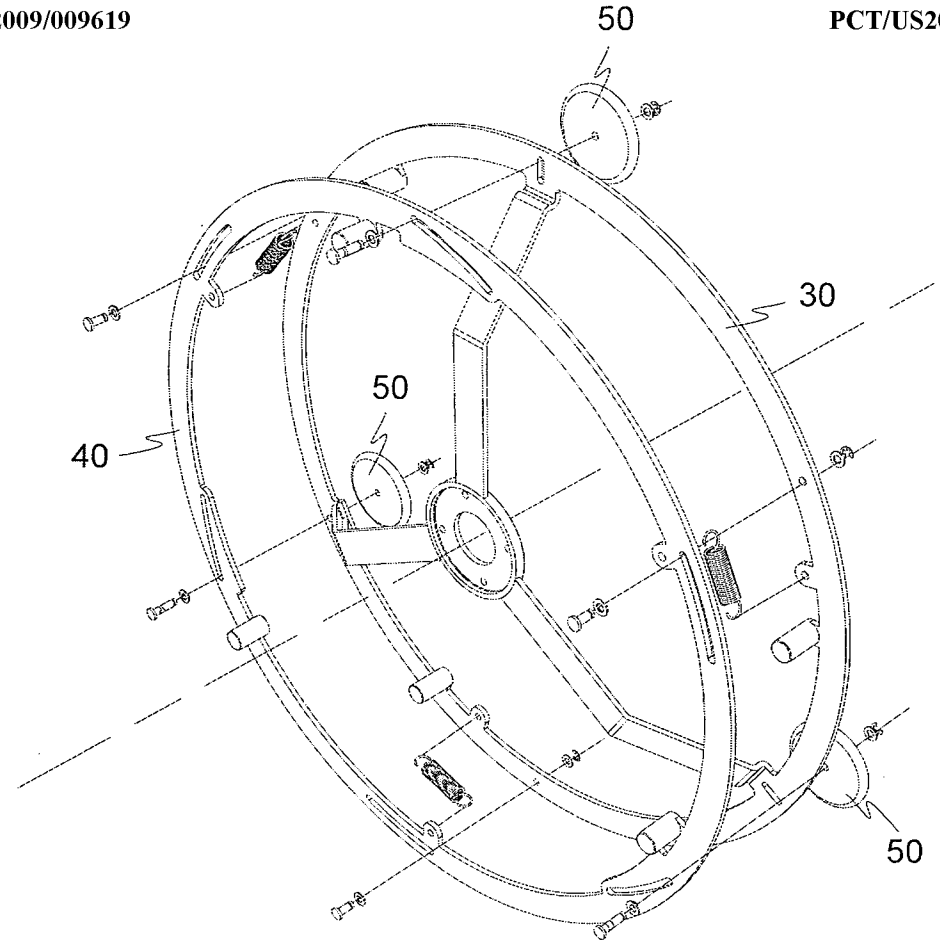


FIG. 6A

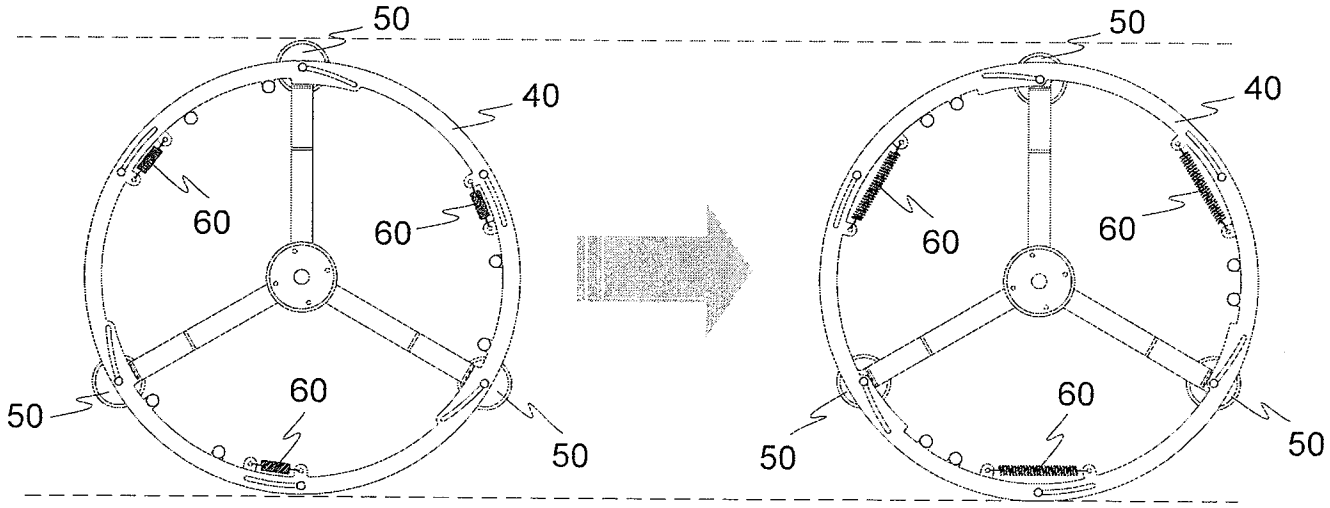


FIG. 6B

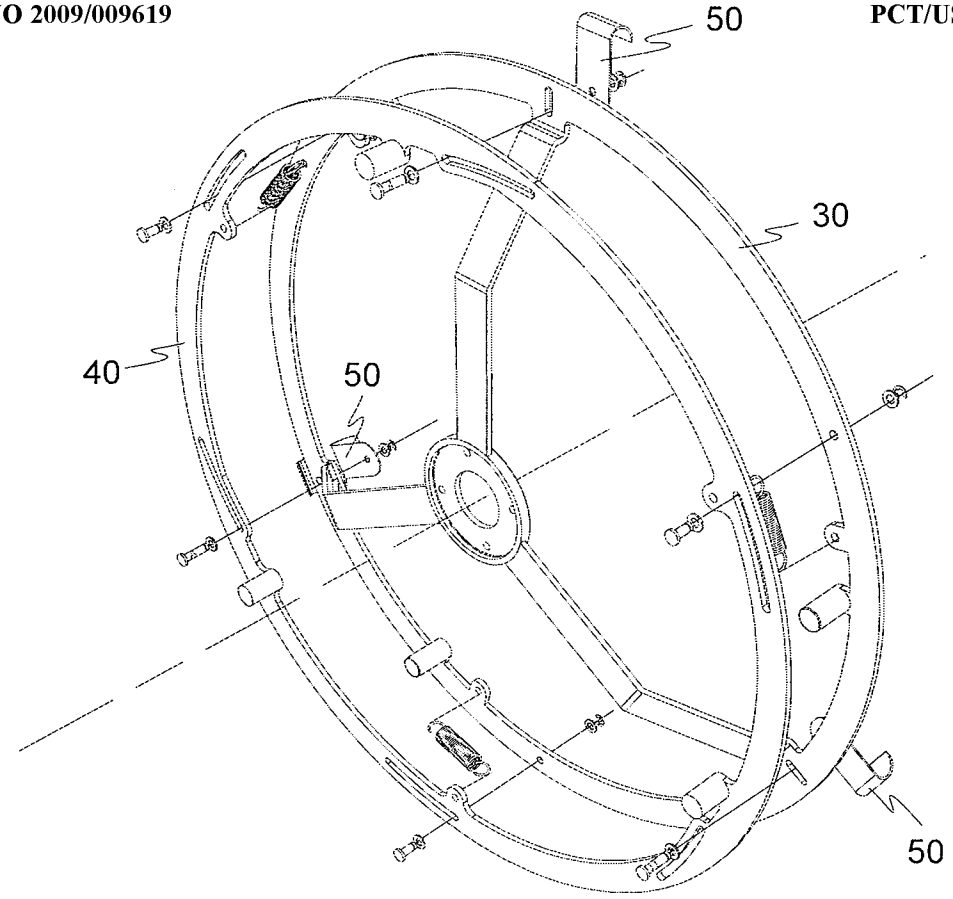


FIG. 7A

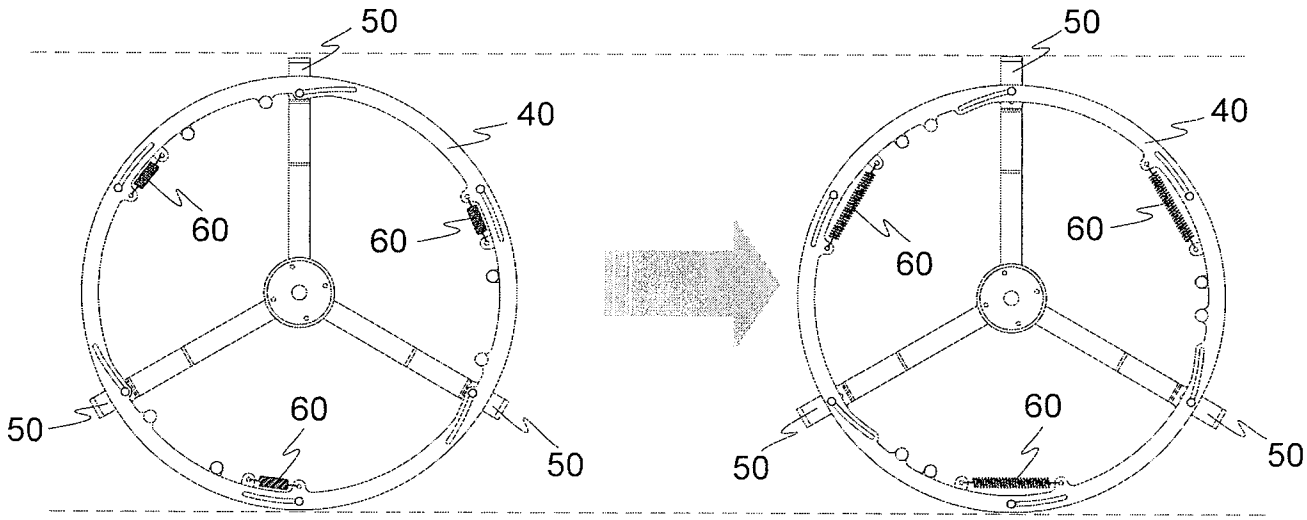


FIG. 7B

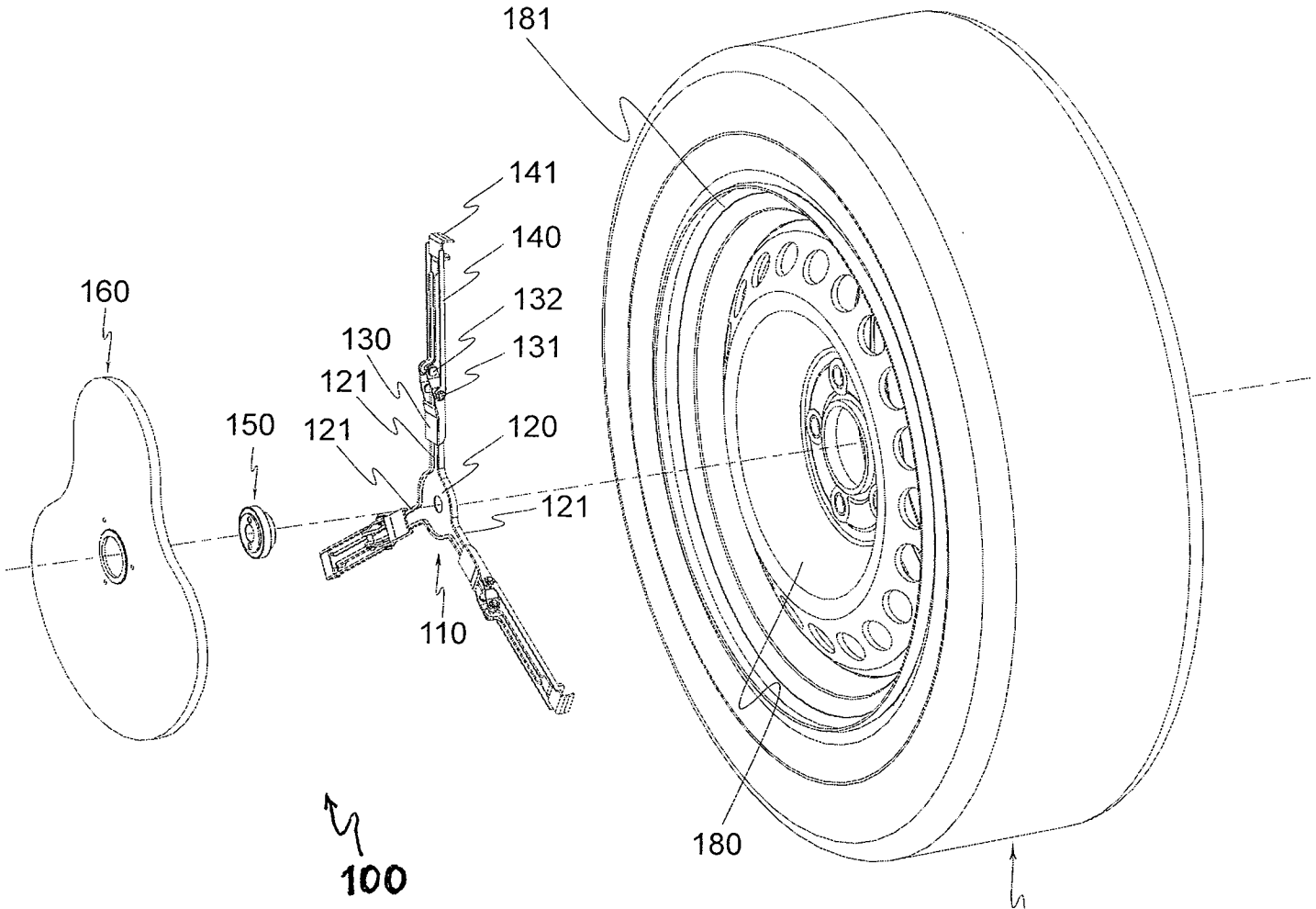


FIG. 8

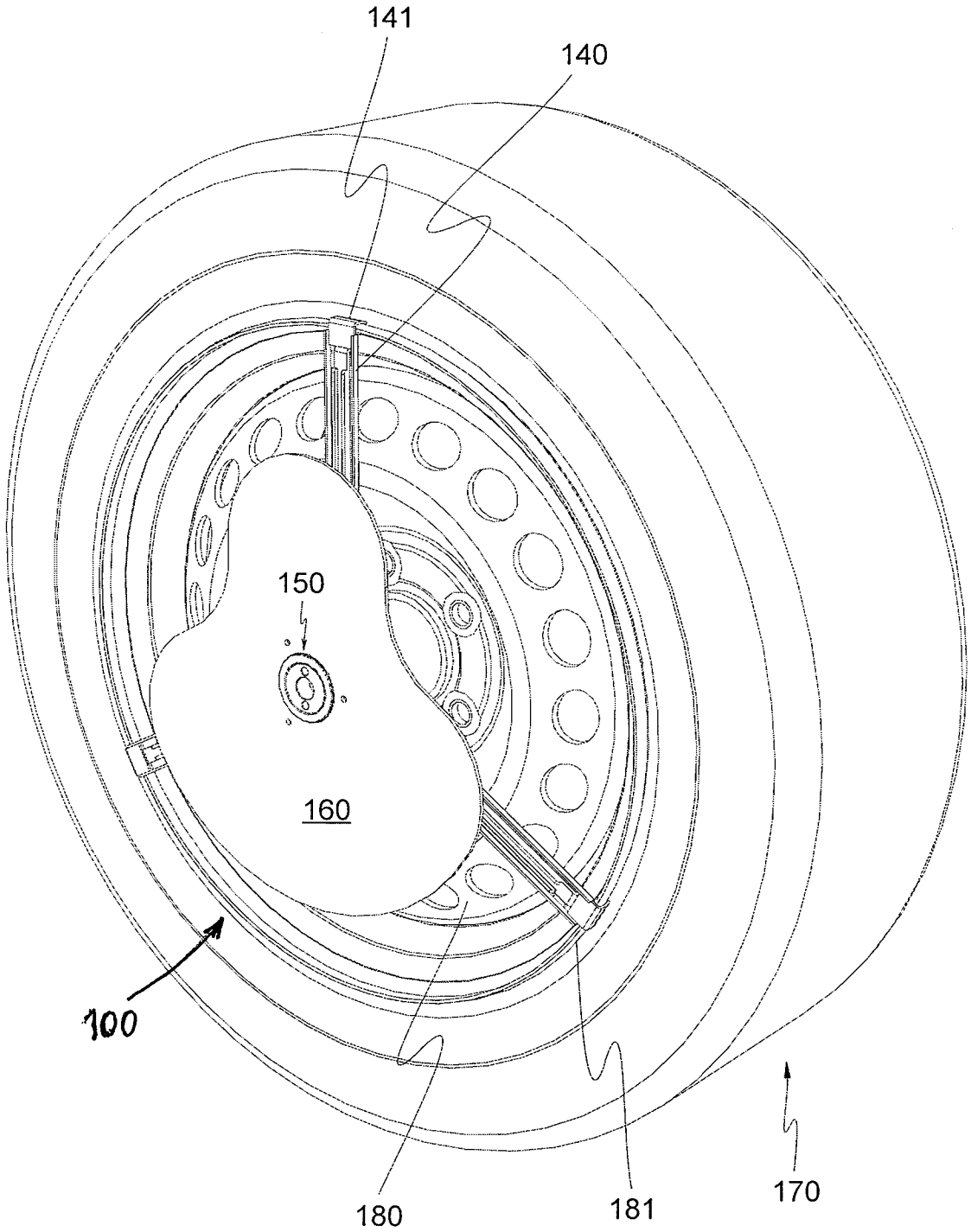


FIG. 9

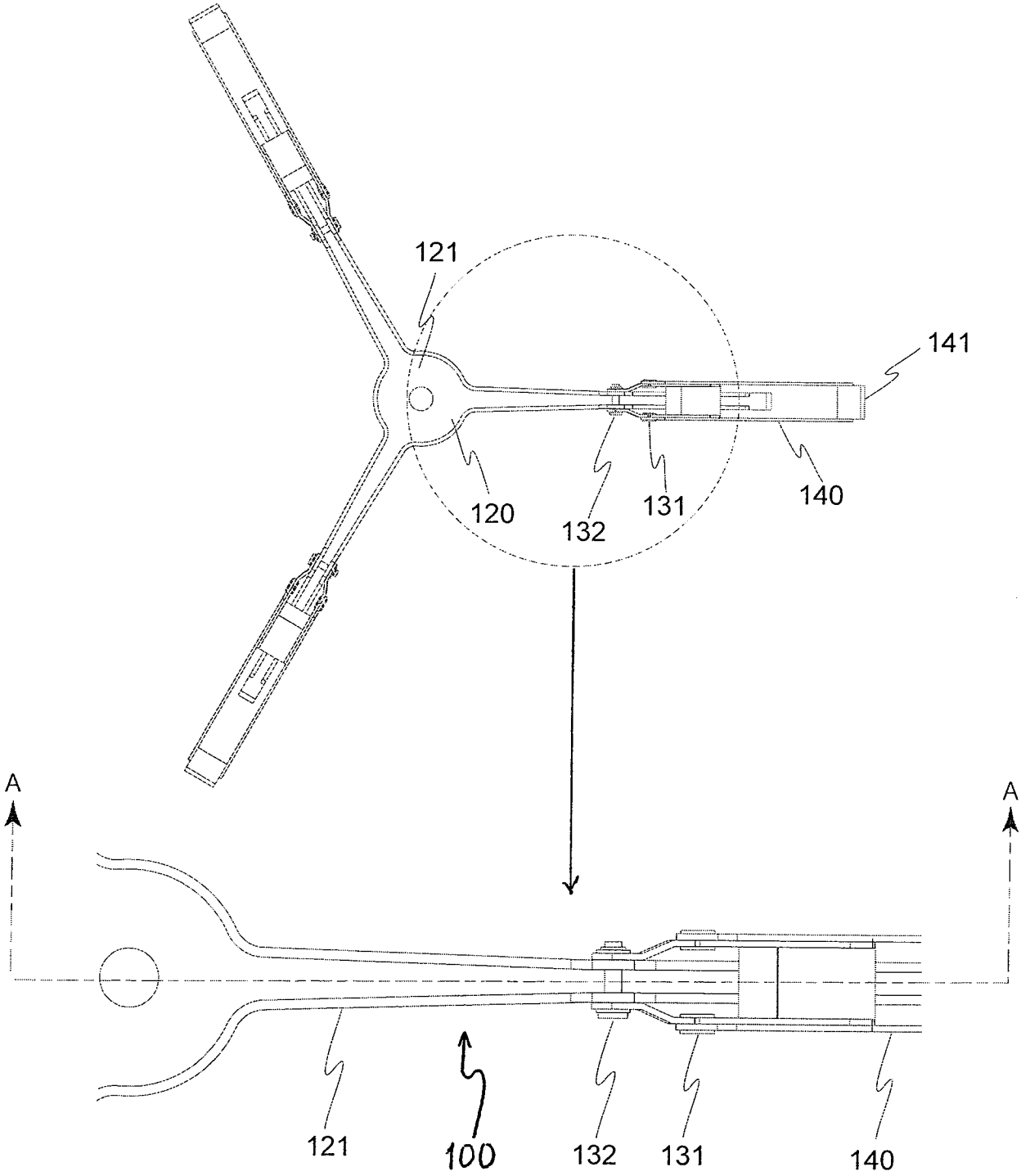


FIG. 10

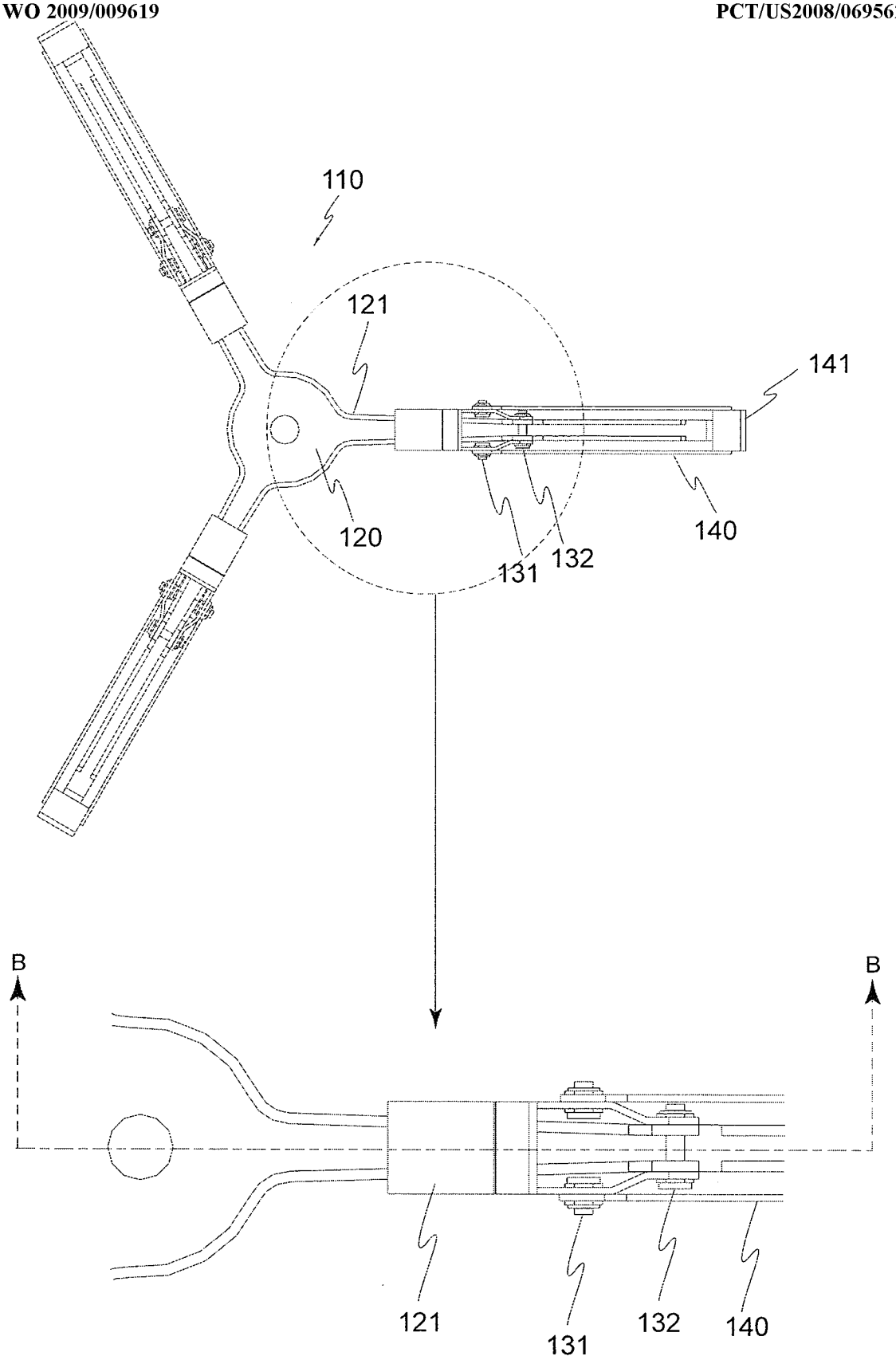


FIG. 11

FIG. 12A

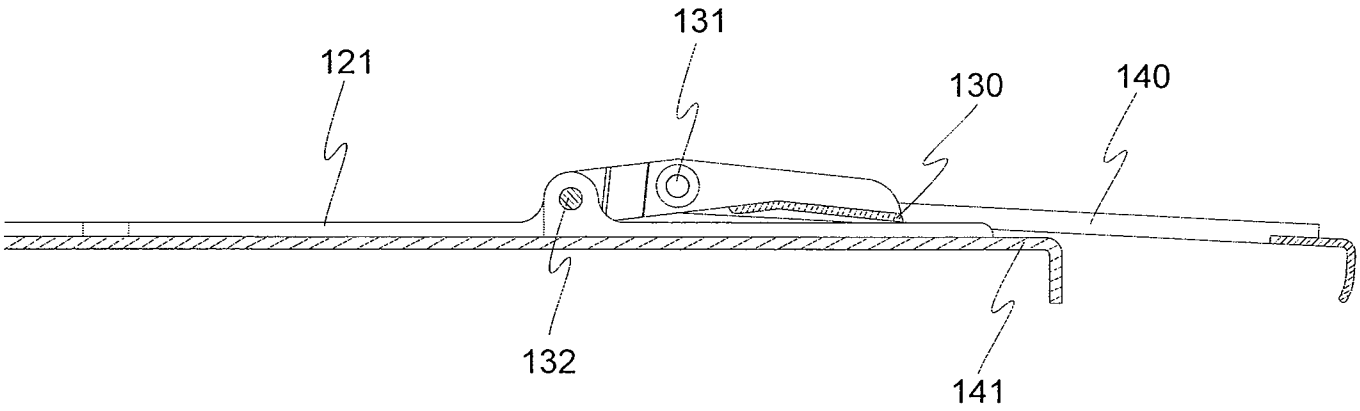
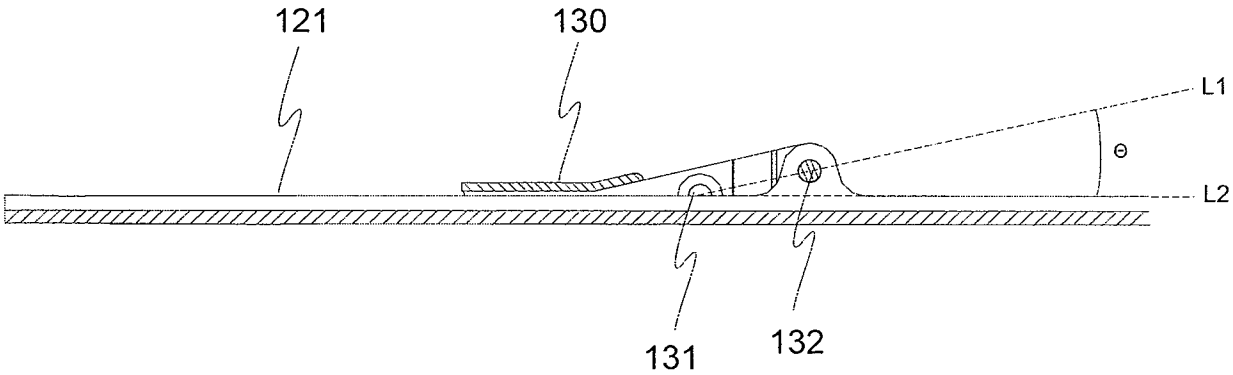


FIG. 12B



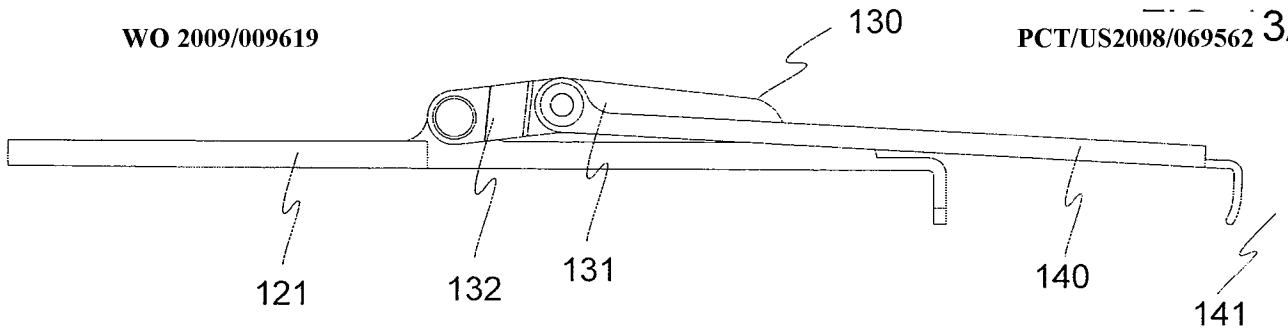


FIG. 13A

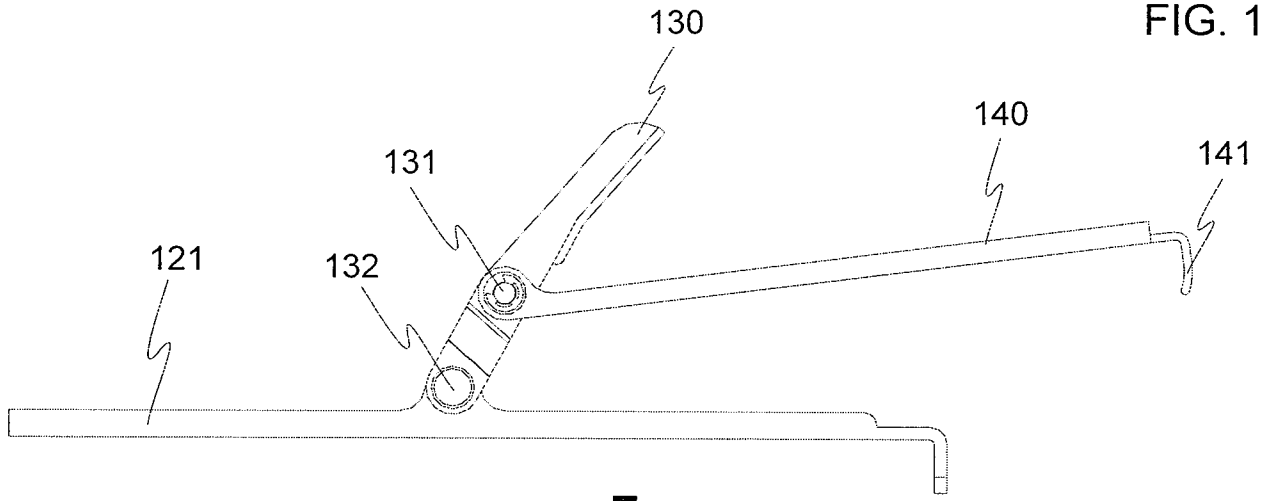


FIG. 13B

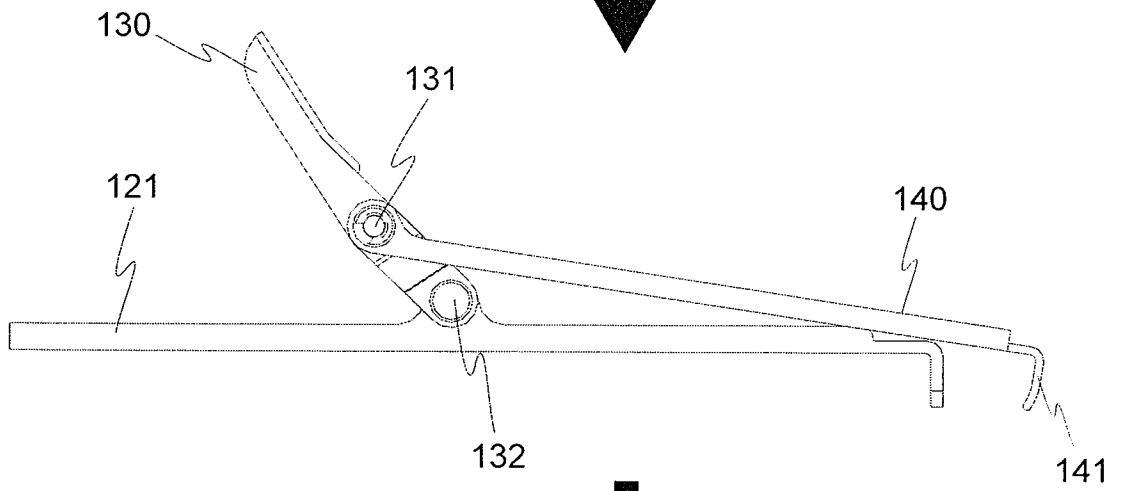


FIG. 13C

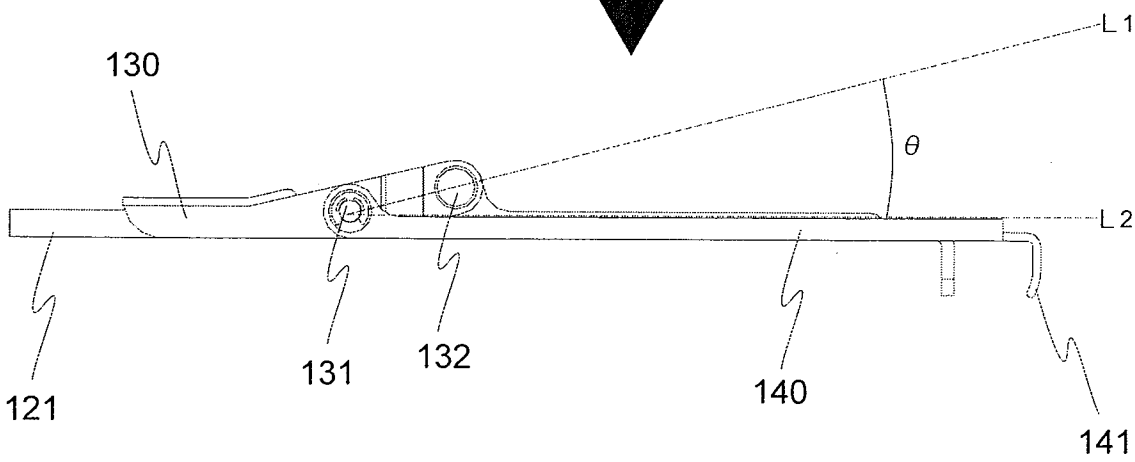


FIG. 13D

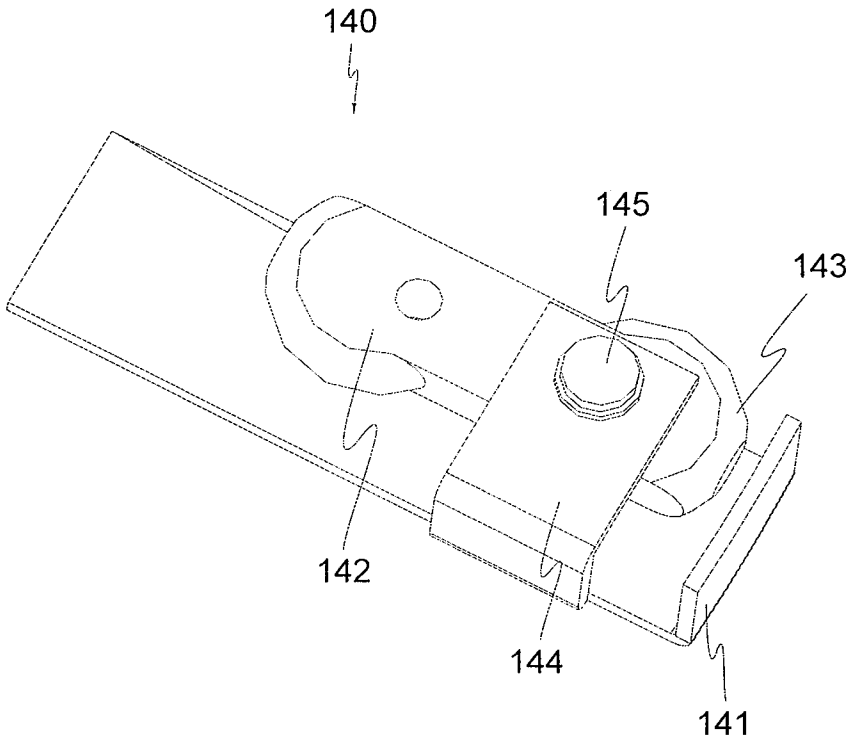


FIG. 14

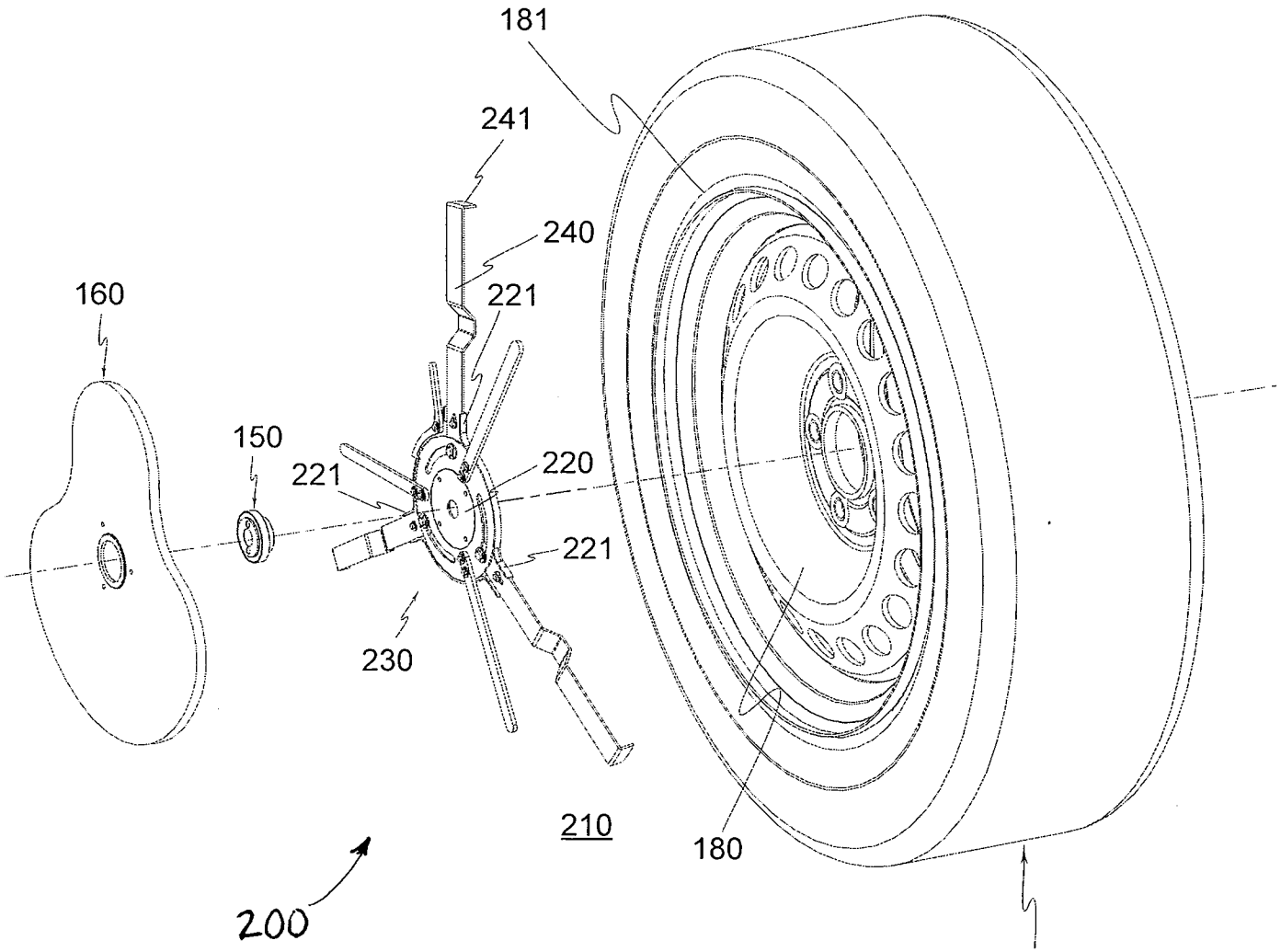


FIG. 15

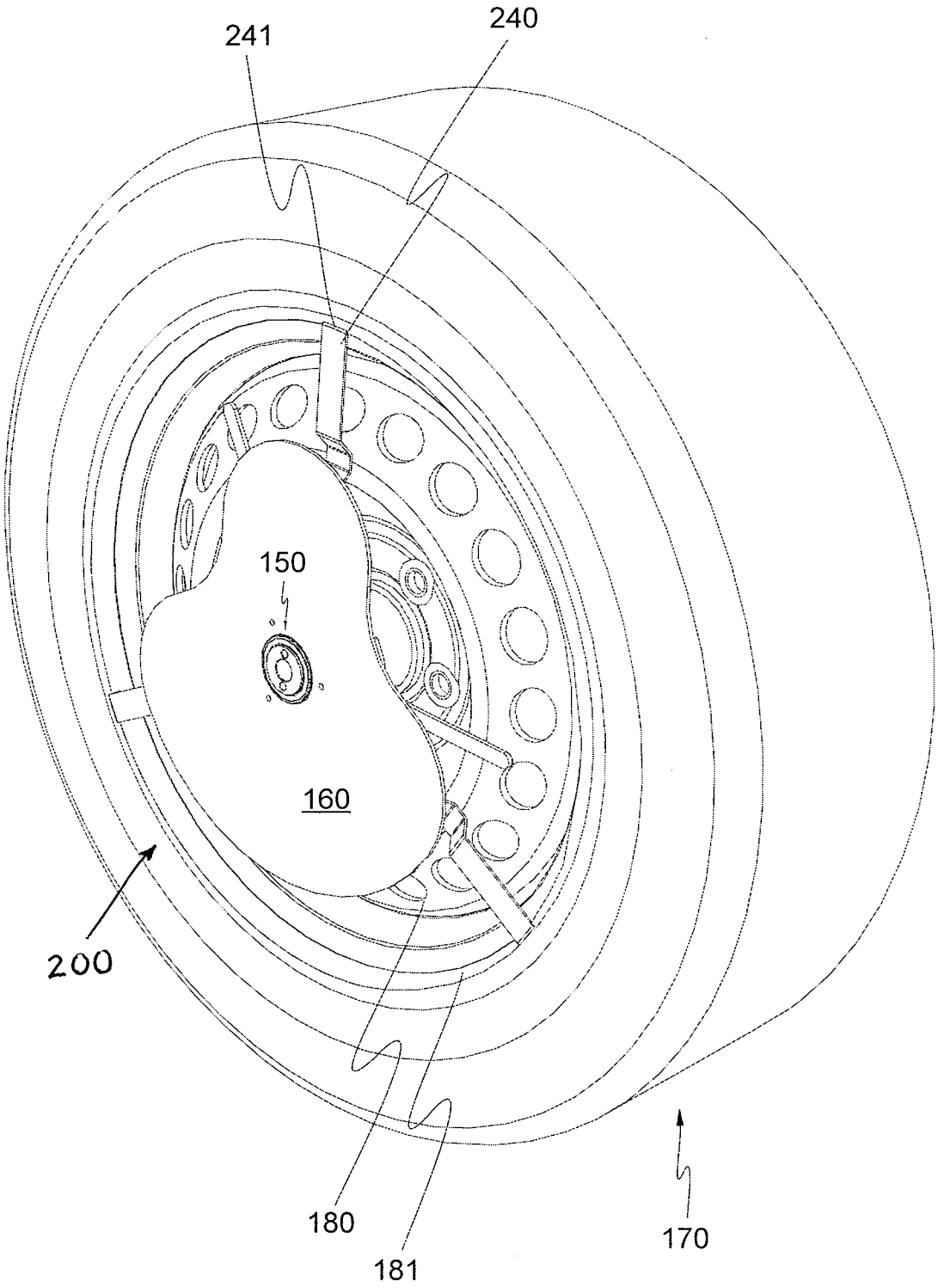


FIG. 16

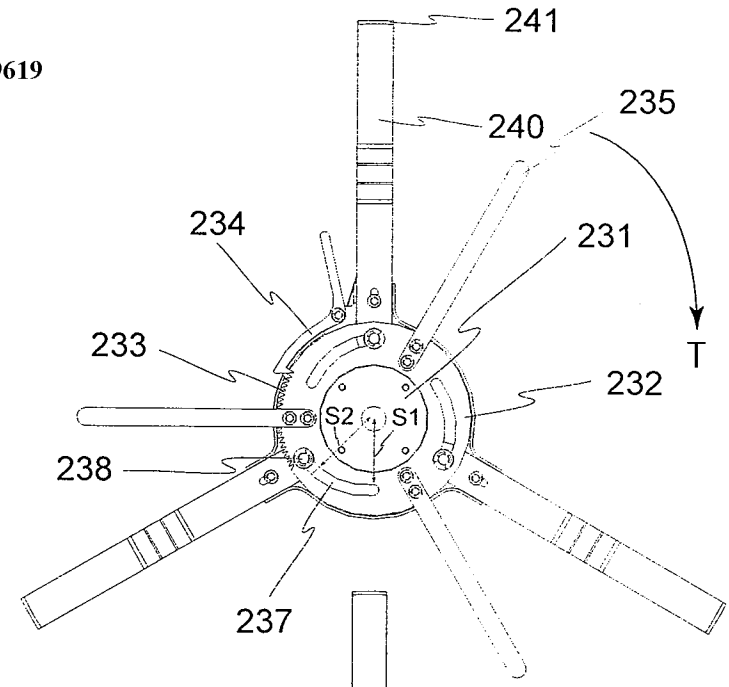


FIG. 17A

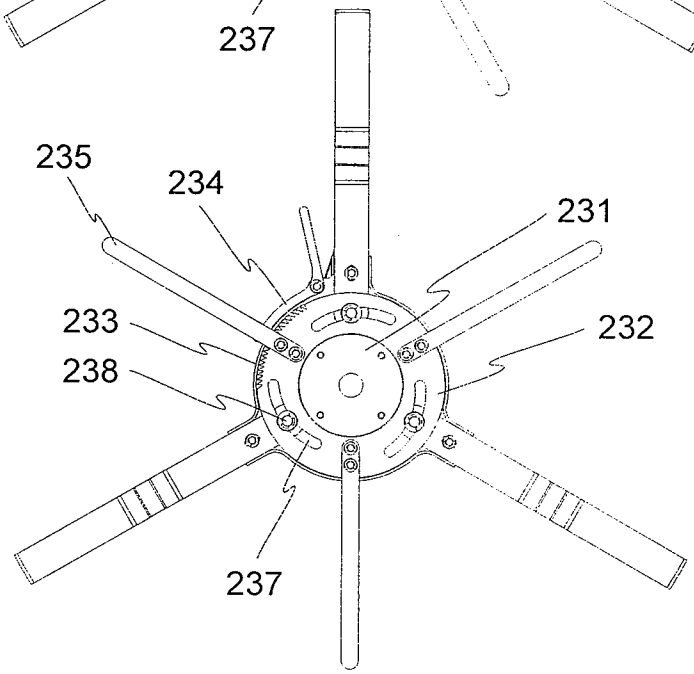


FIG. 17B

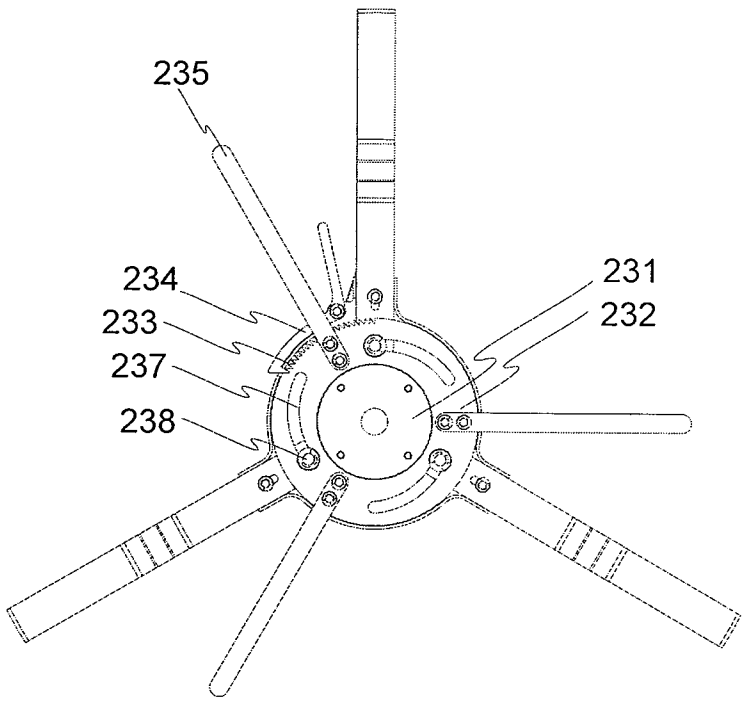


FIG. 17C

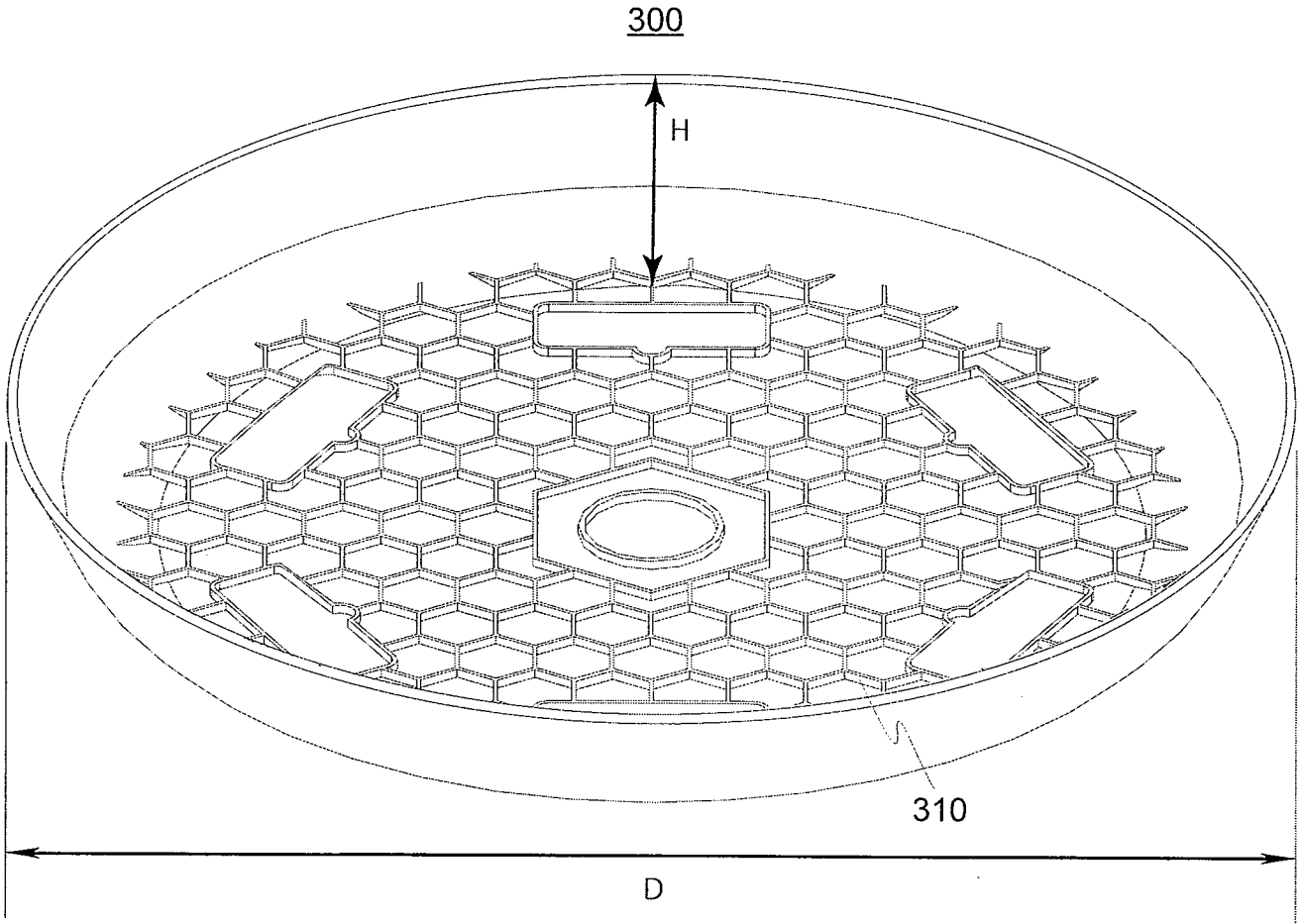


FIG. 18

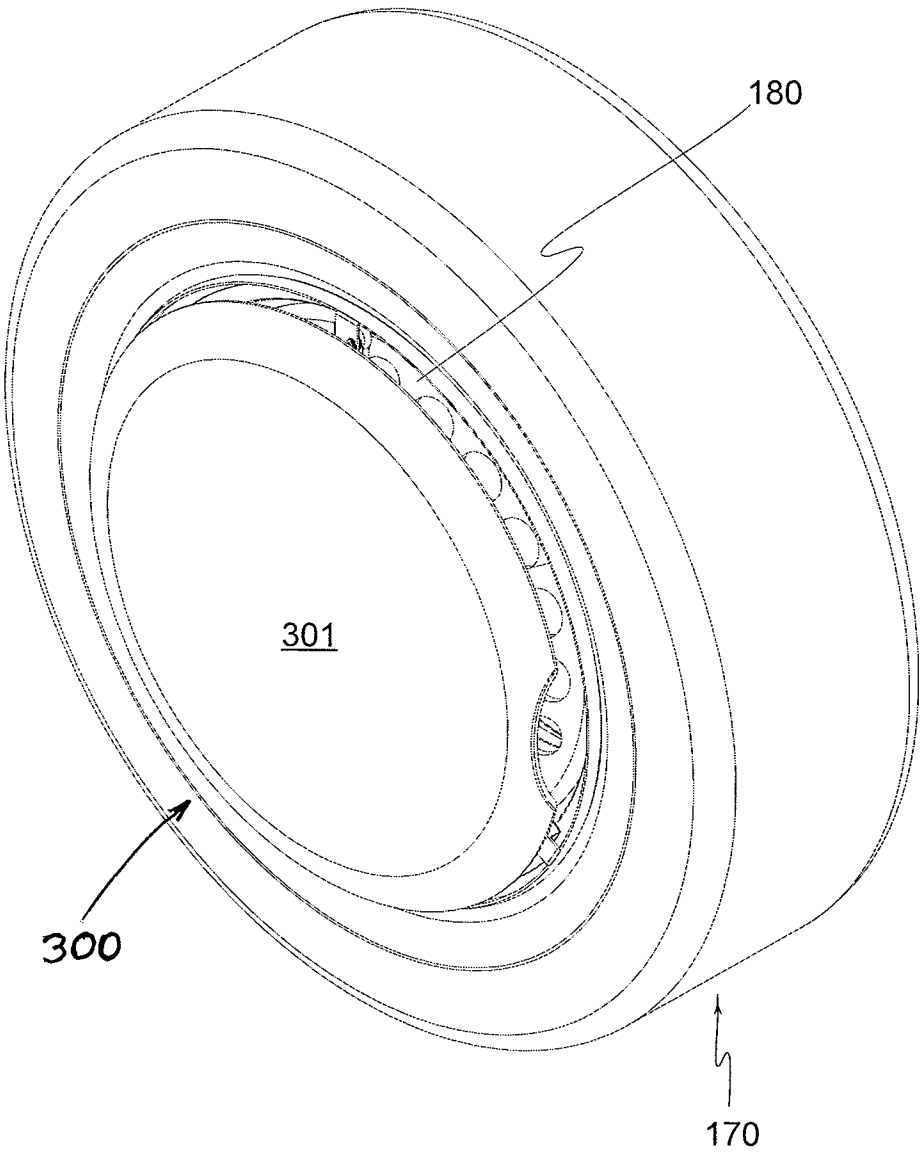
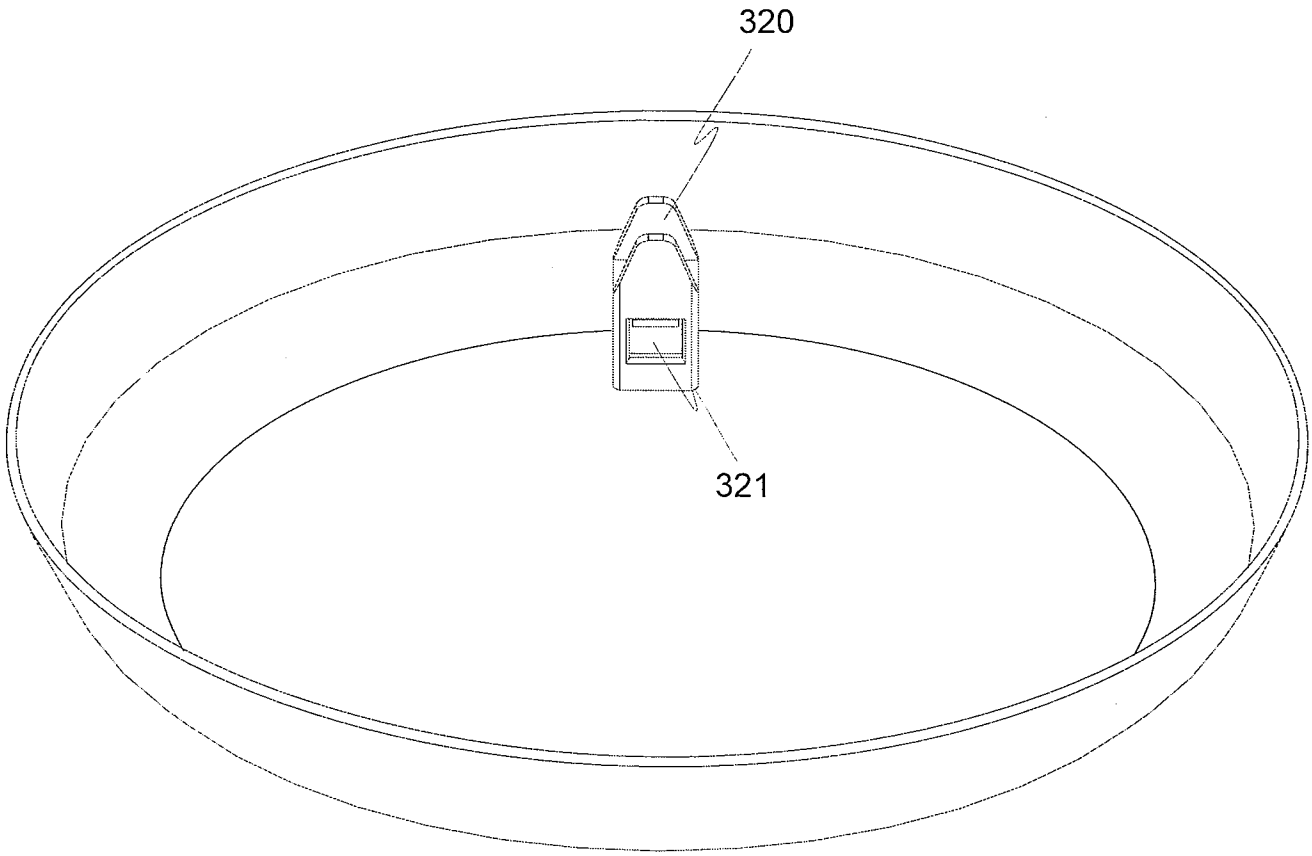


FIG. 19



300

FIG. 20

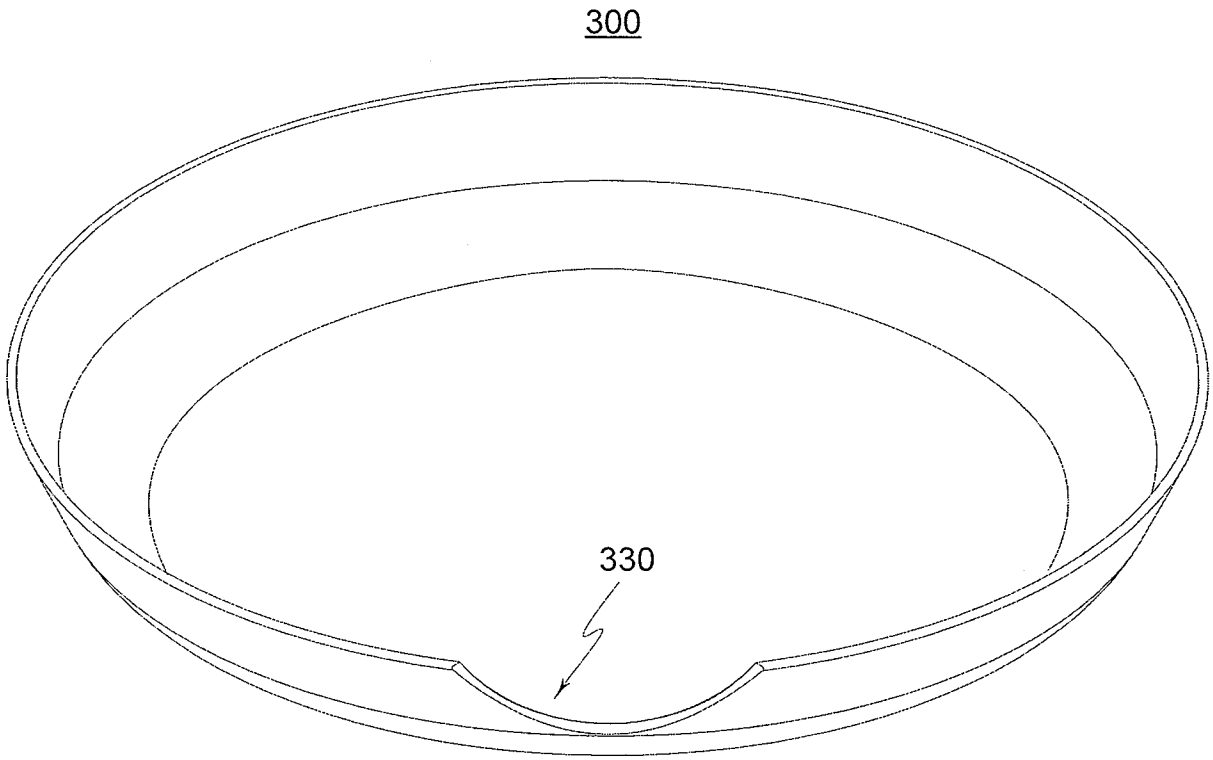
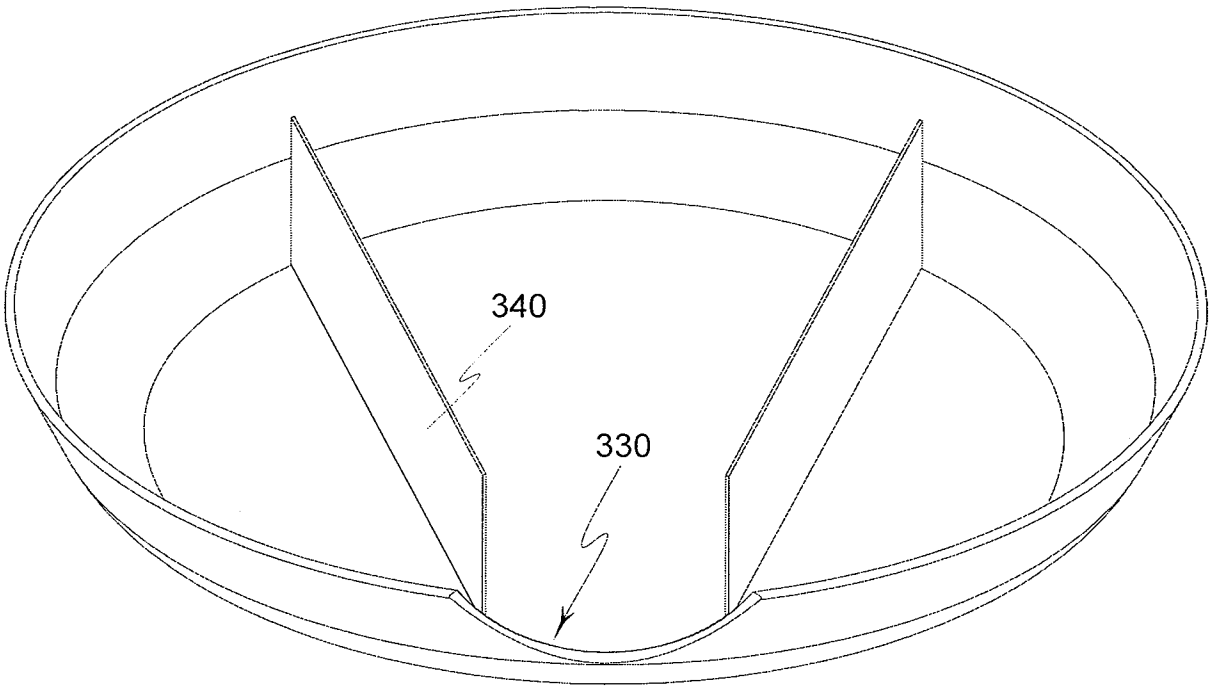


FIG. 21



330

FIG. 22

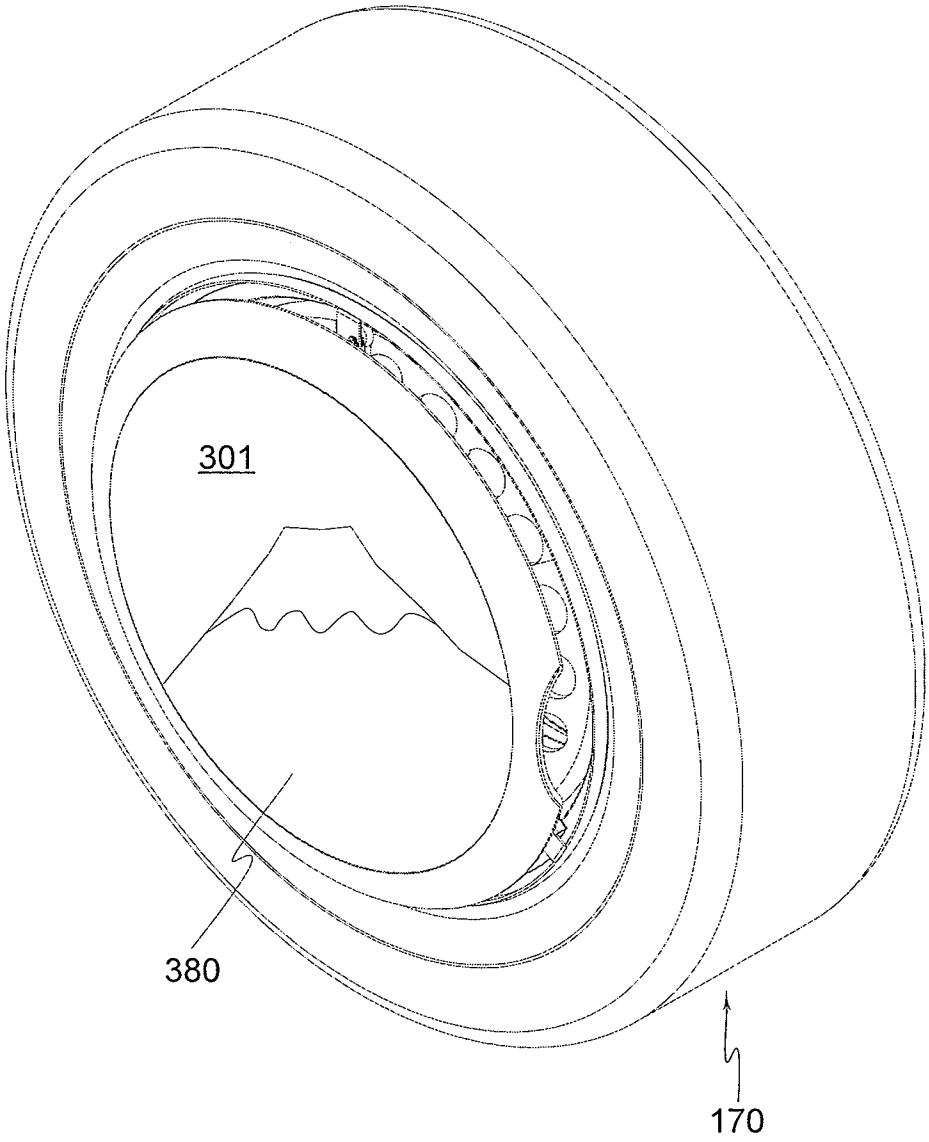


FIG. 23

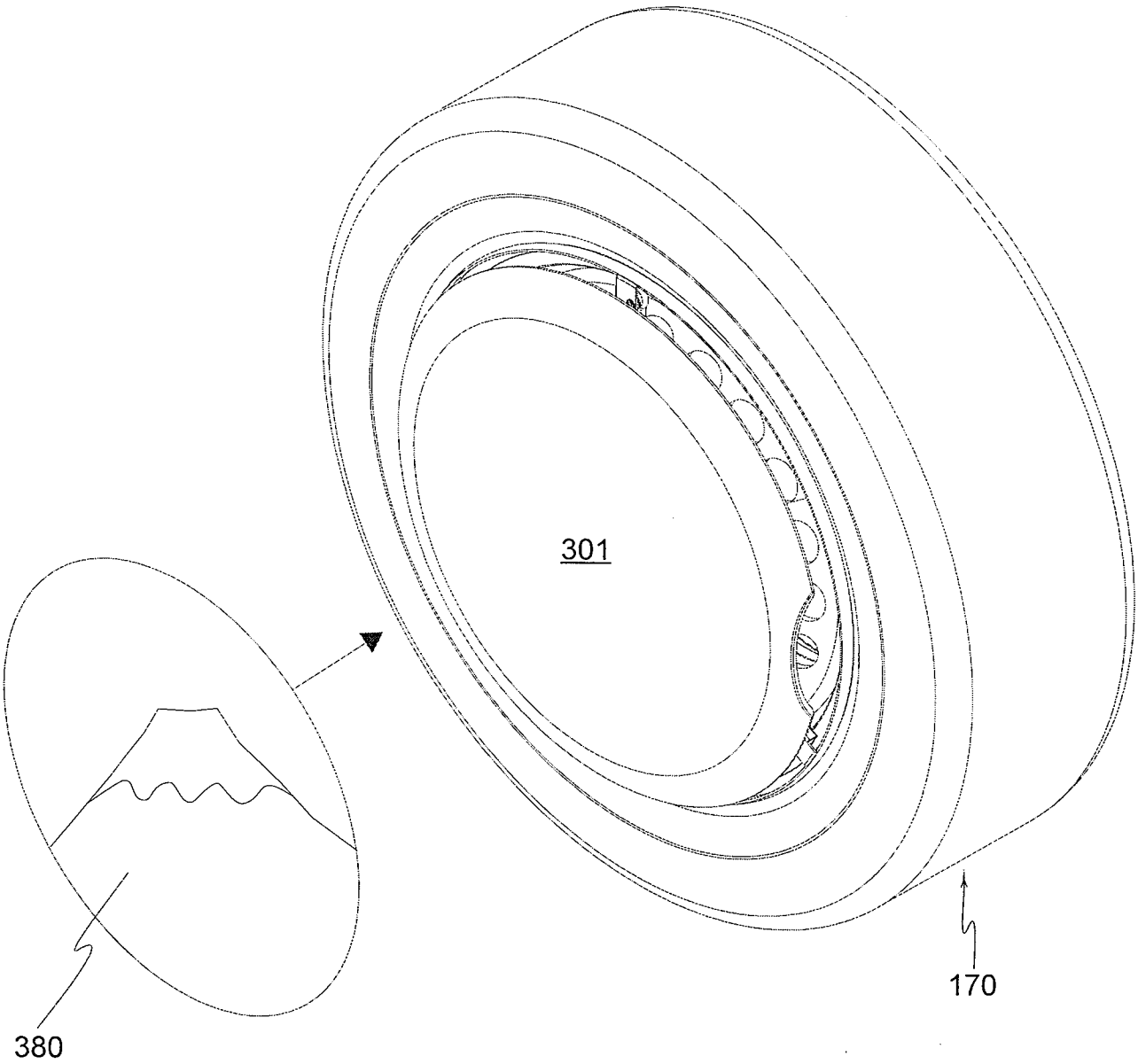


FIG. 24

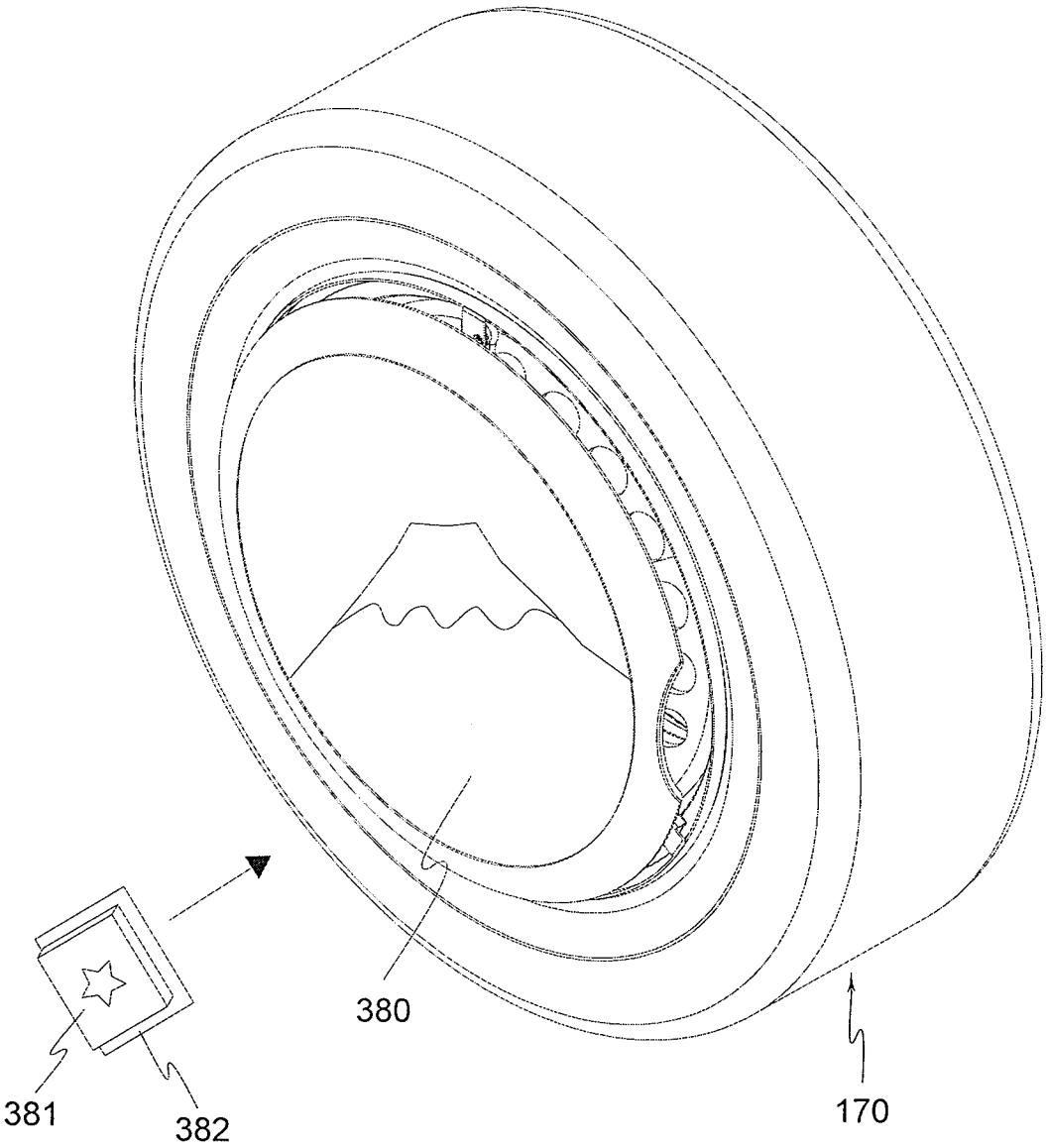


FIG. 25

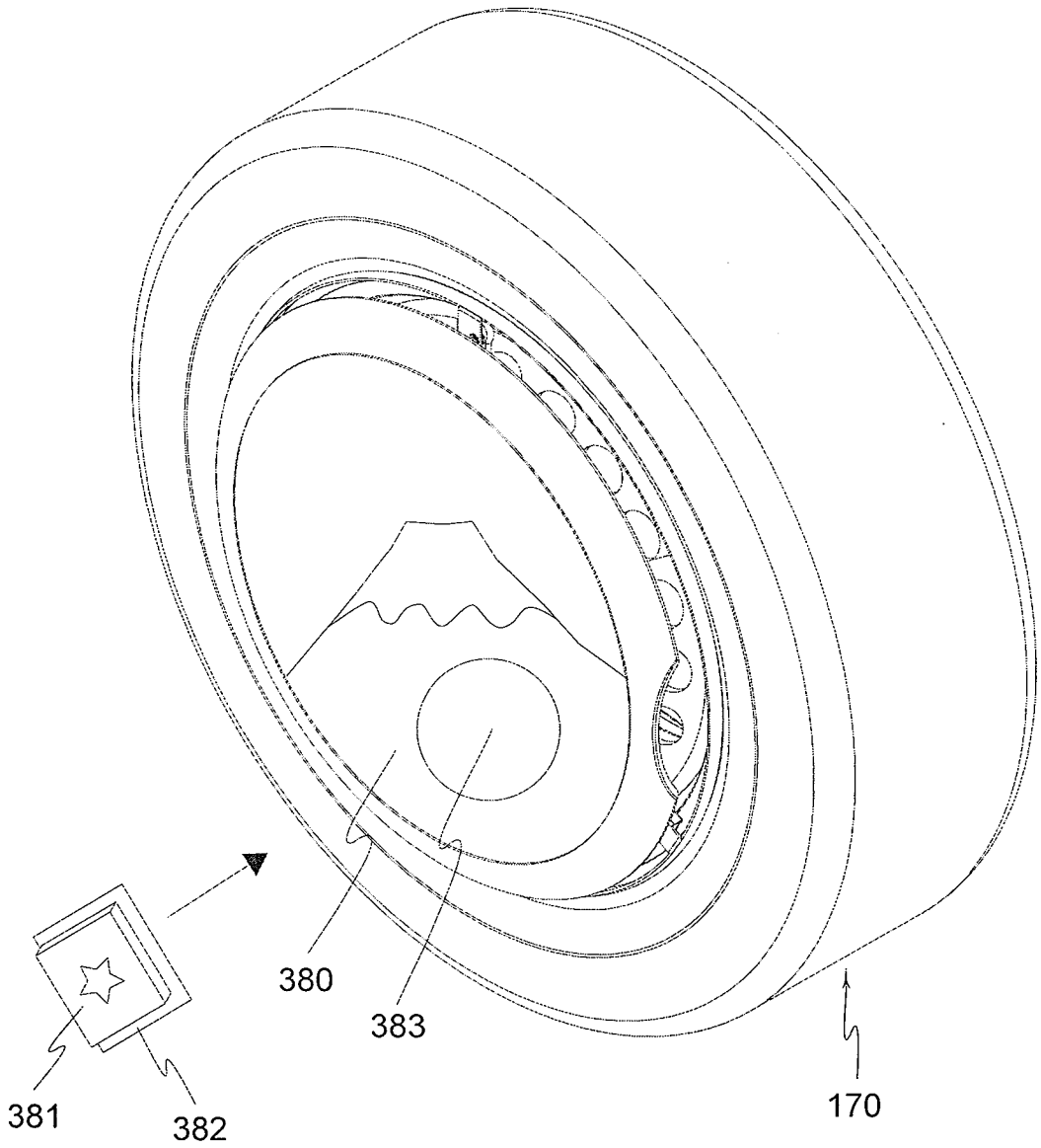


FIG. 26

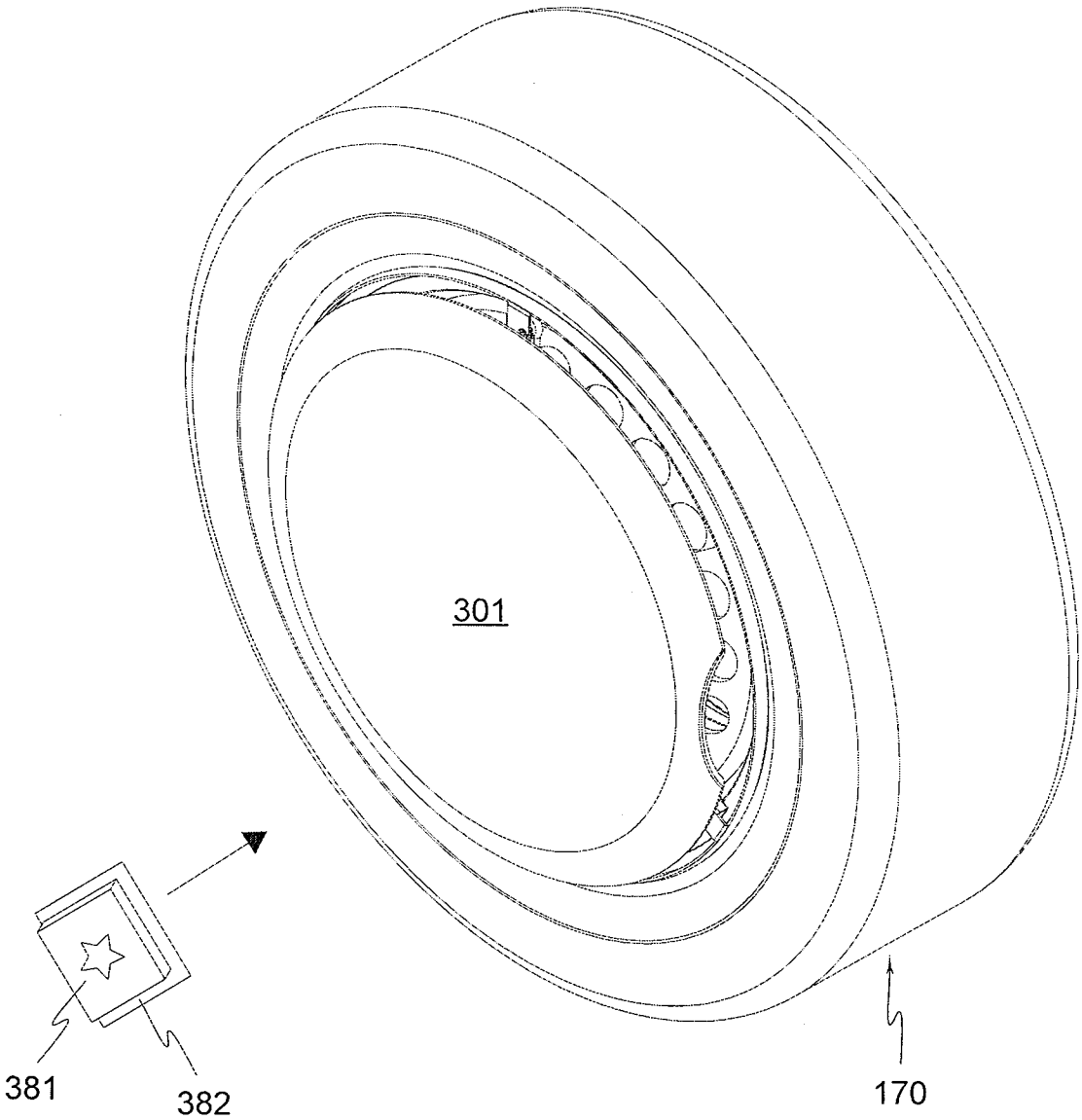


FIG. 27

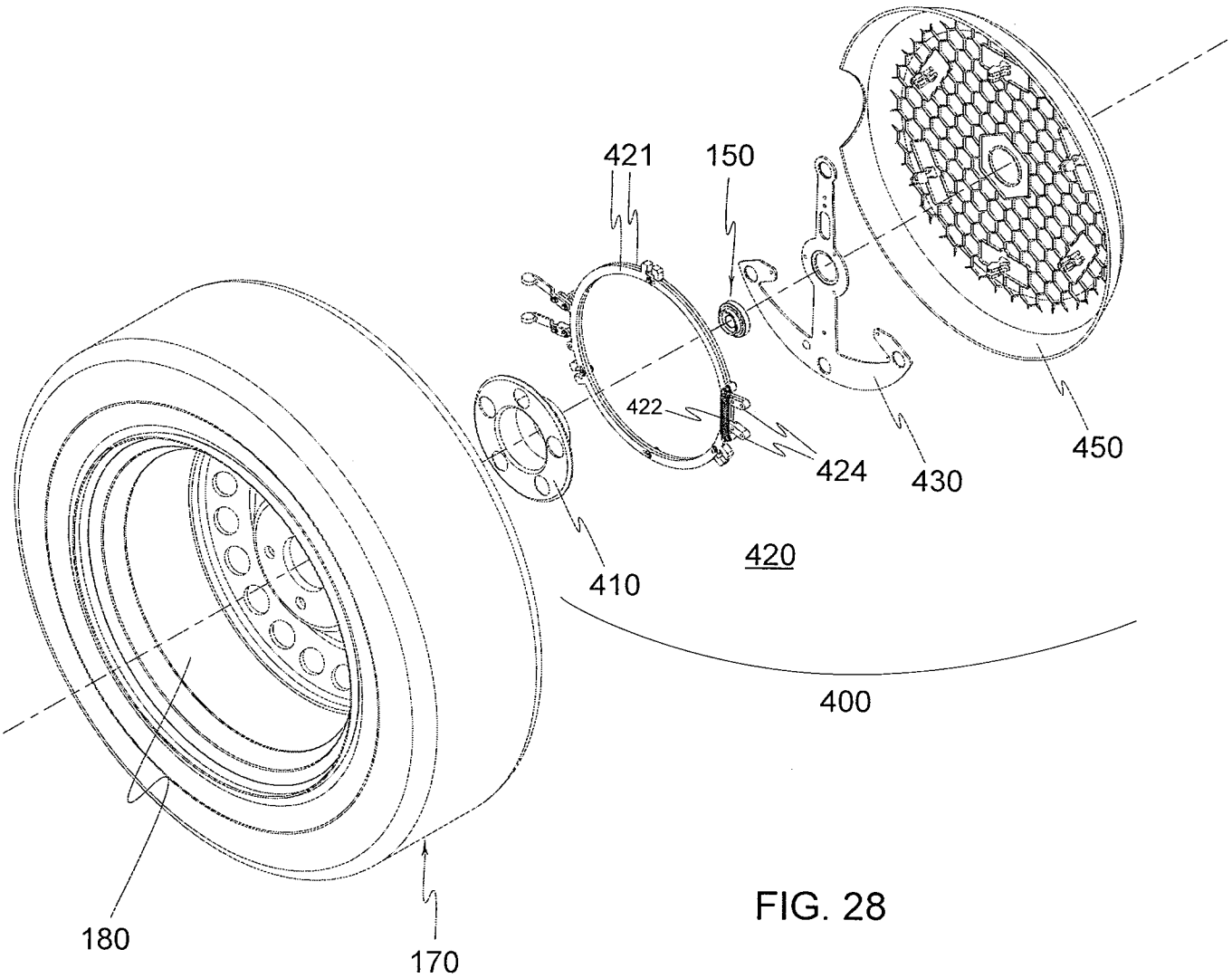


FIG. 28

FIG. 29A

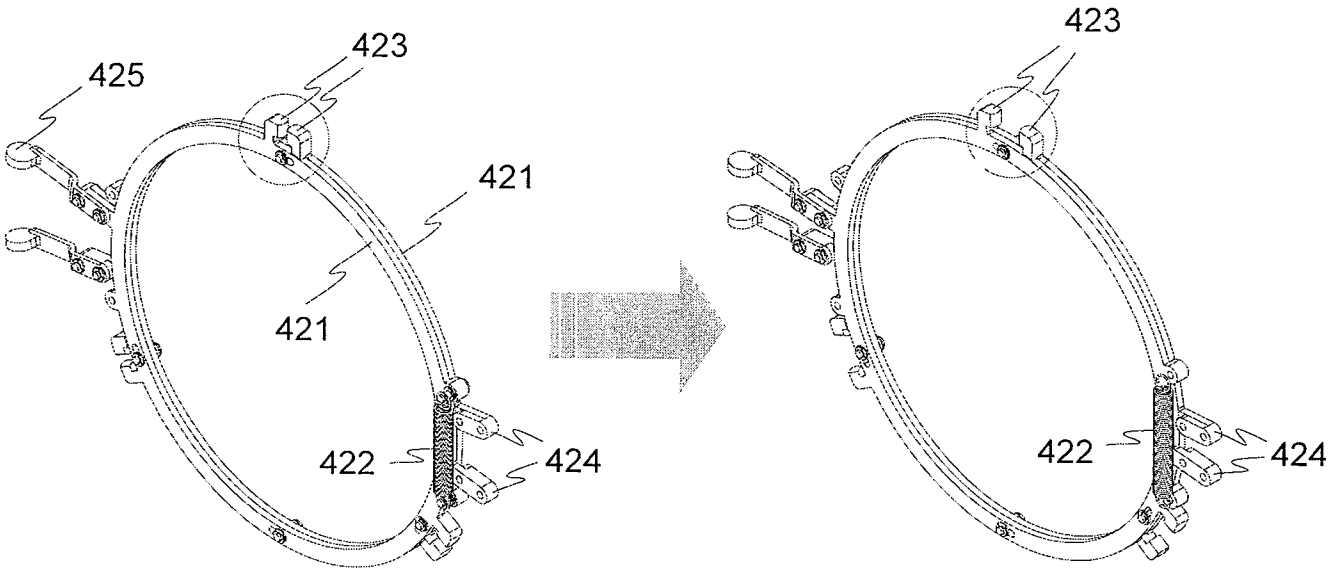
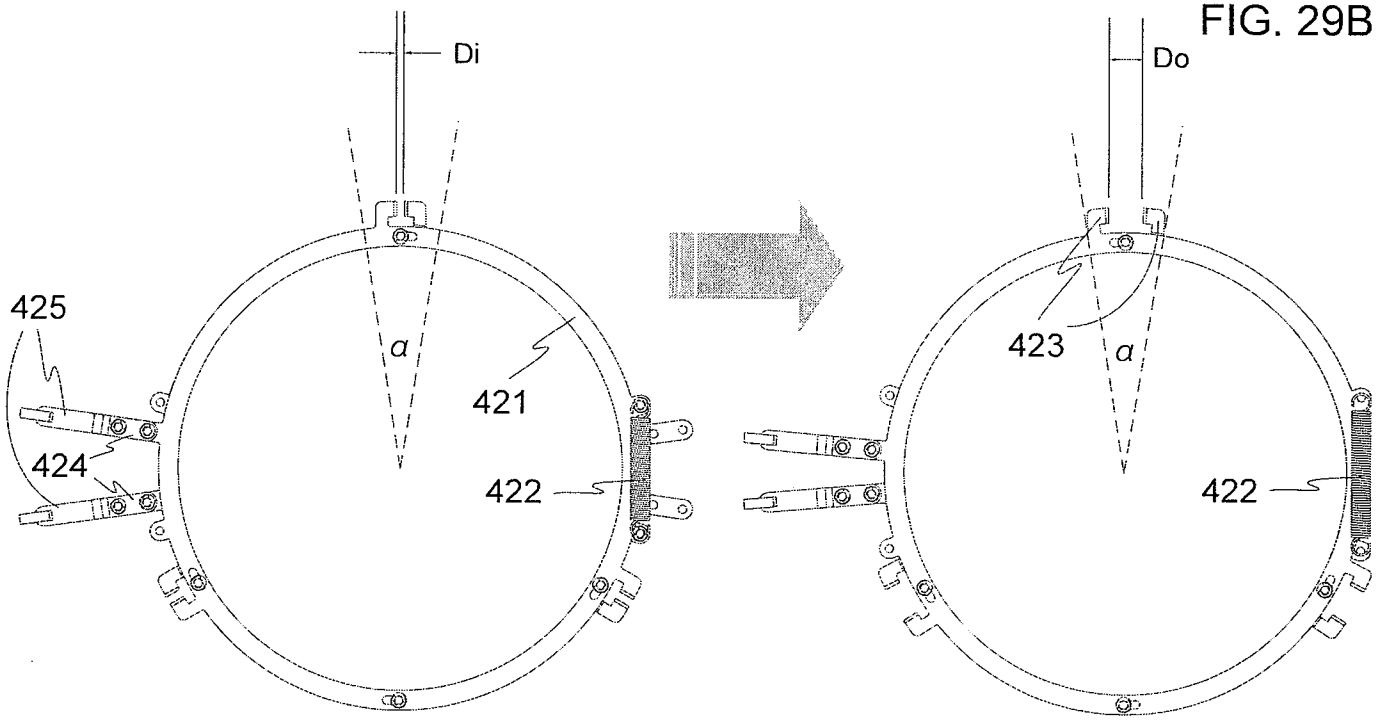


FIG. 29B



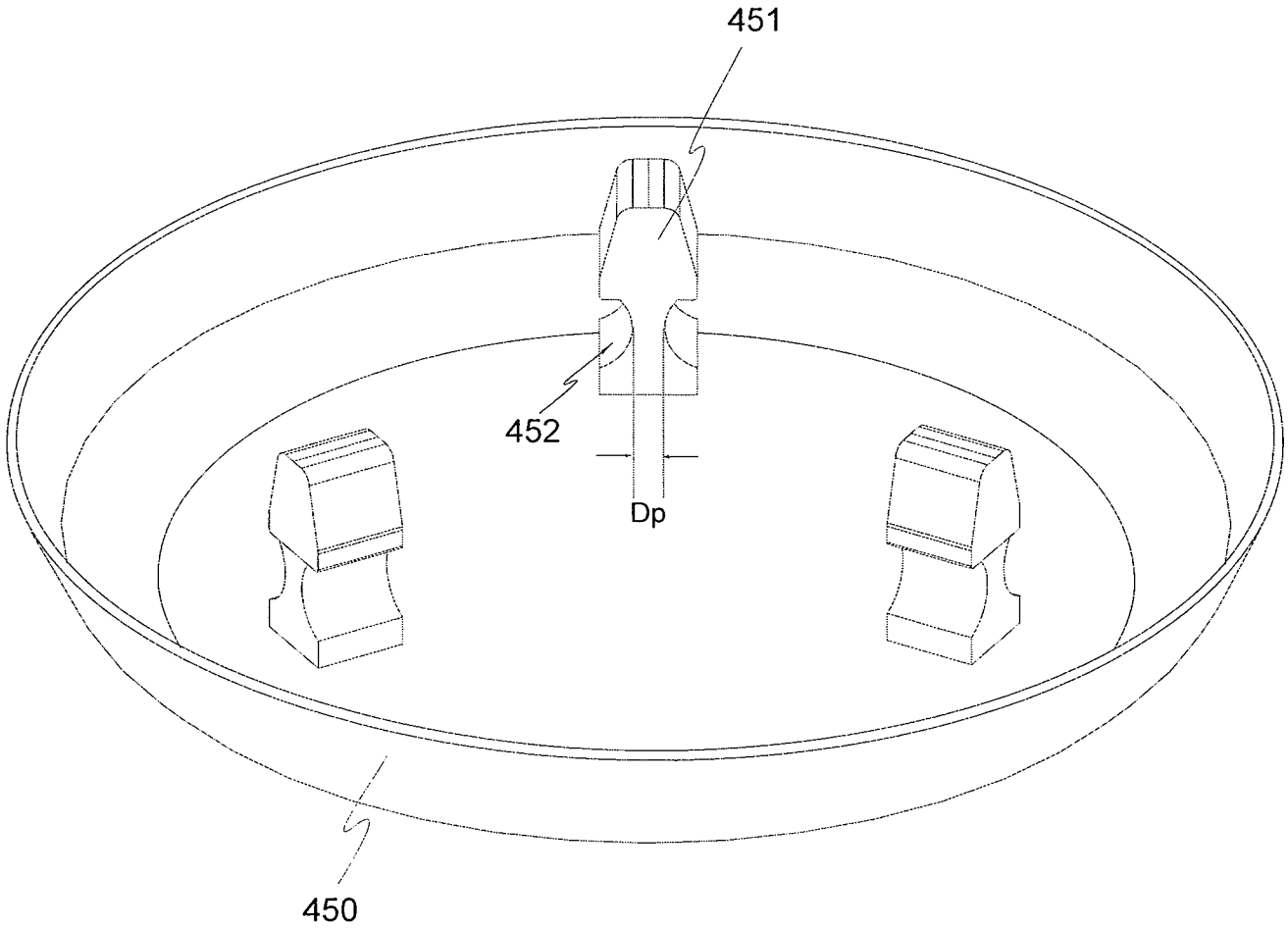


FIG. 30

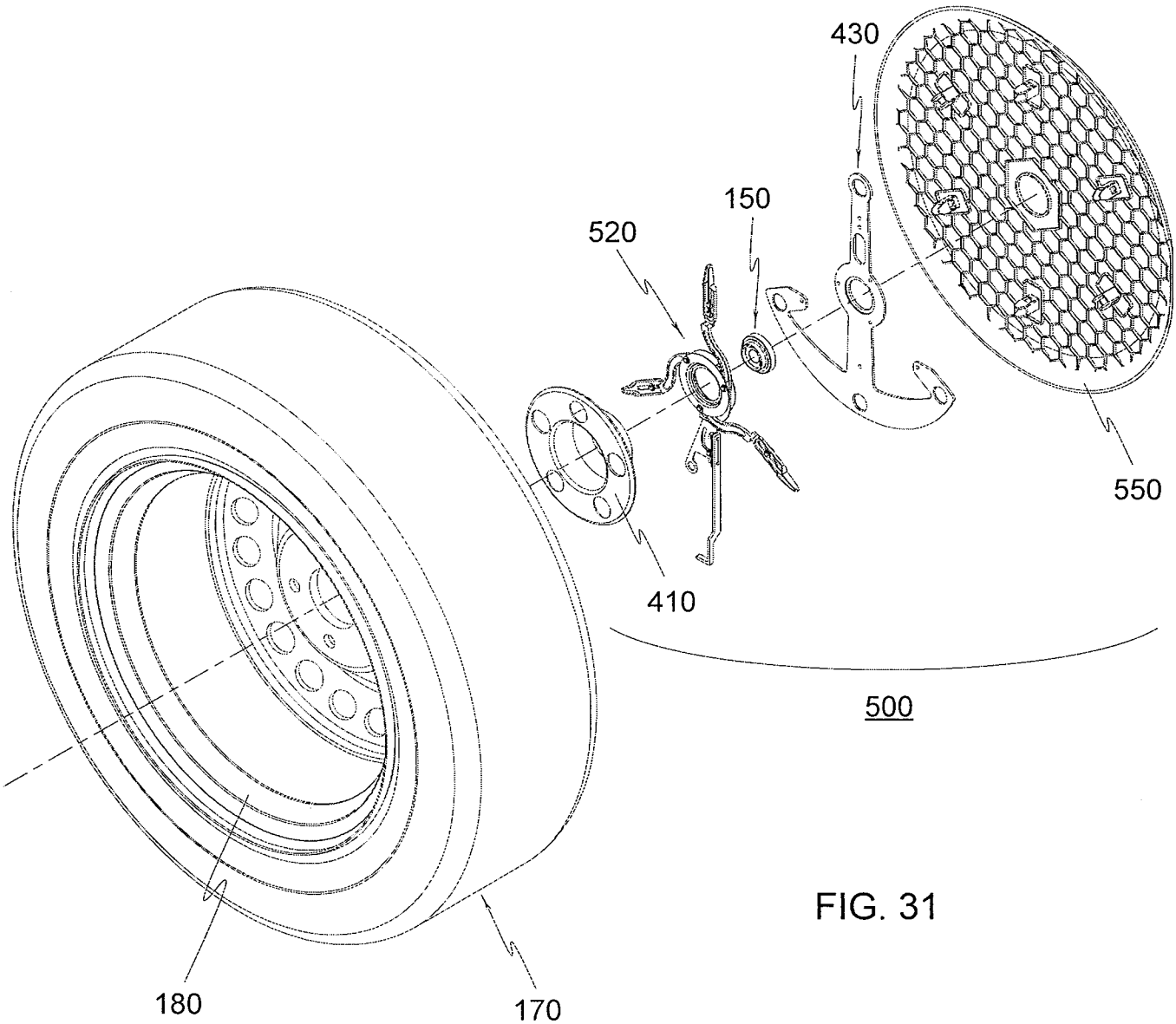


FIG. 31

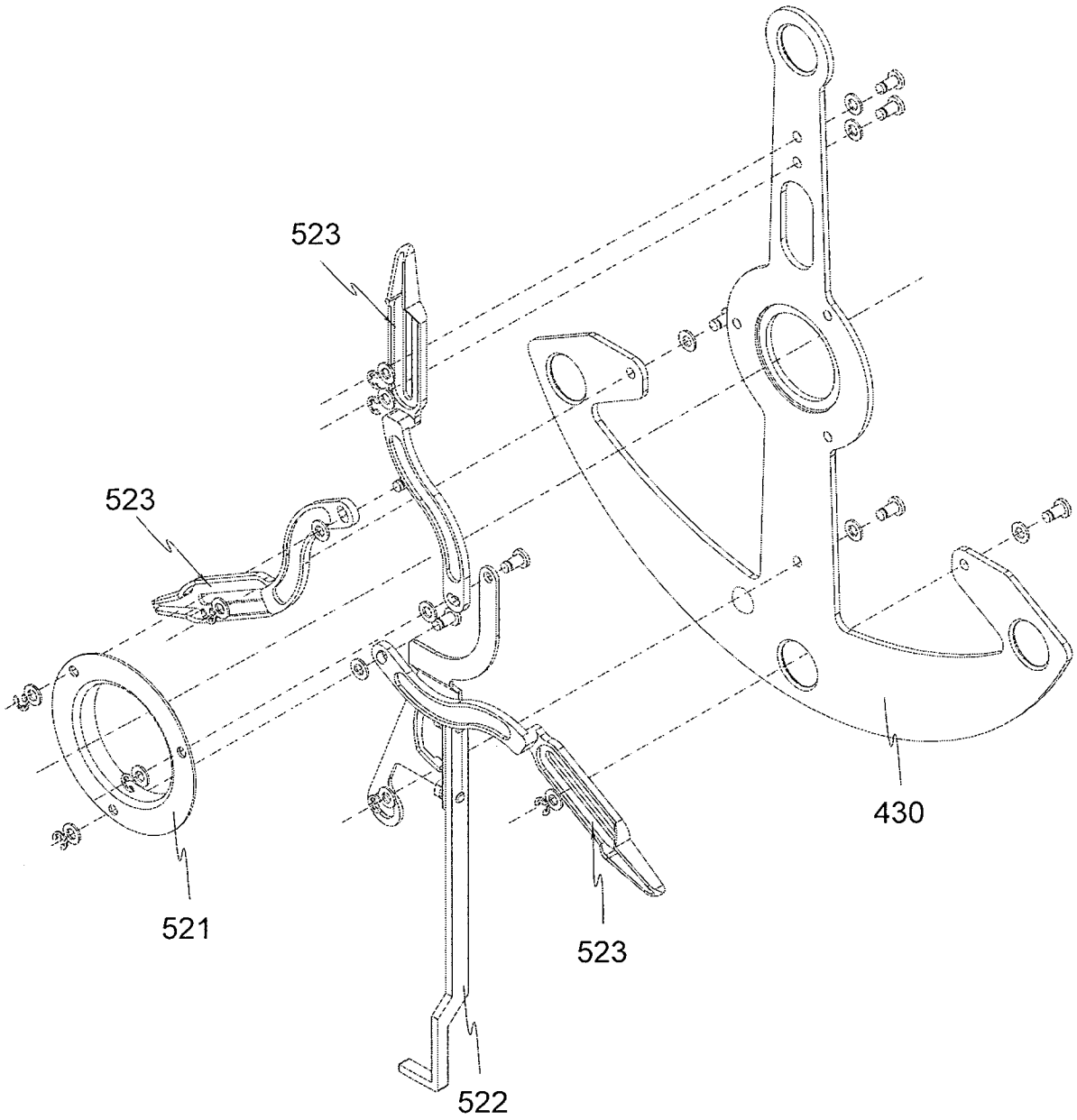


FIG. 32

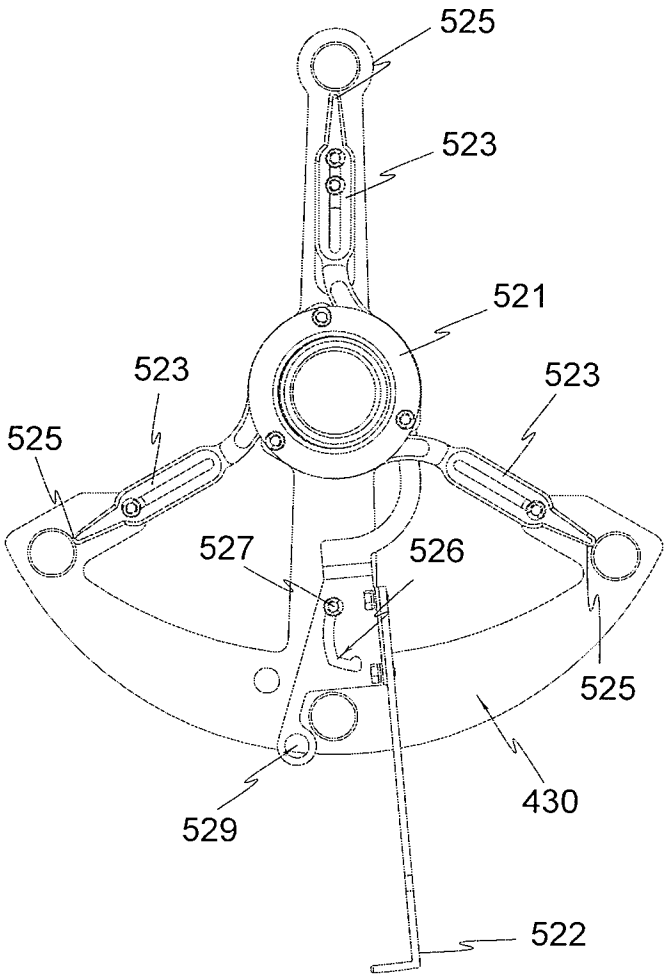


FIG. 33A

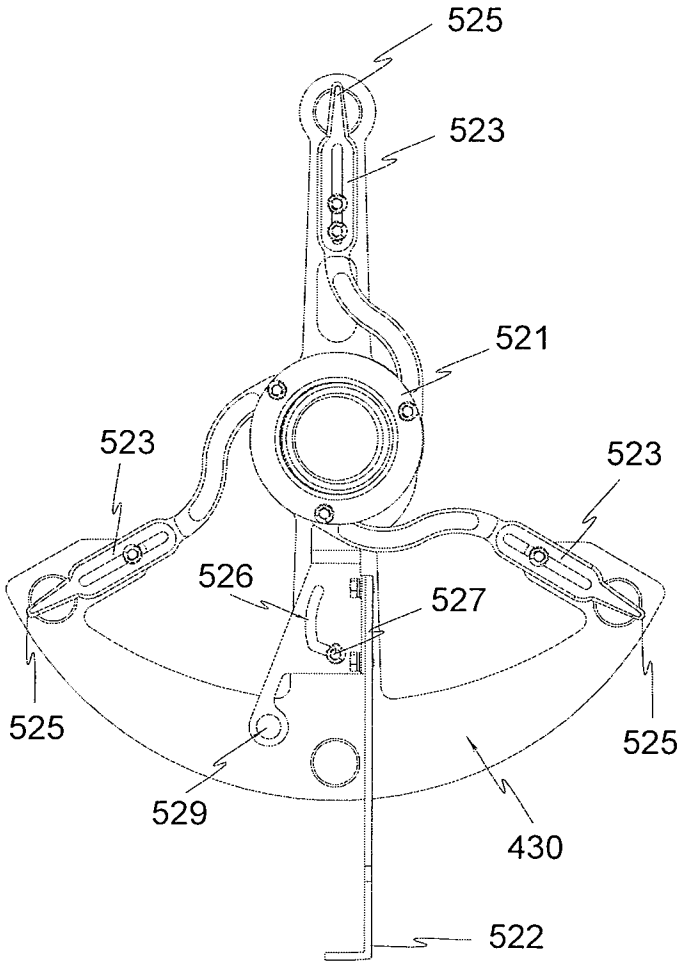
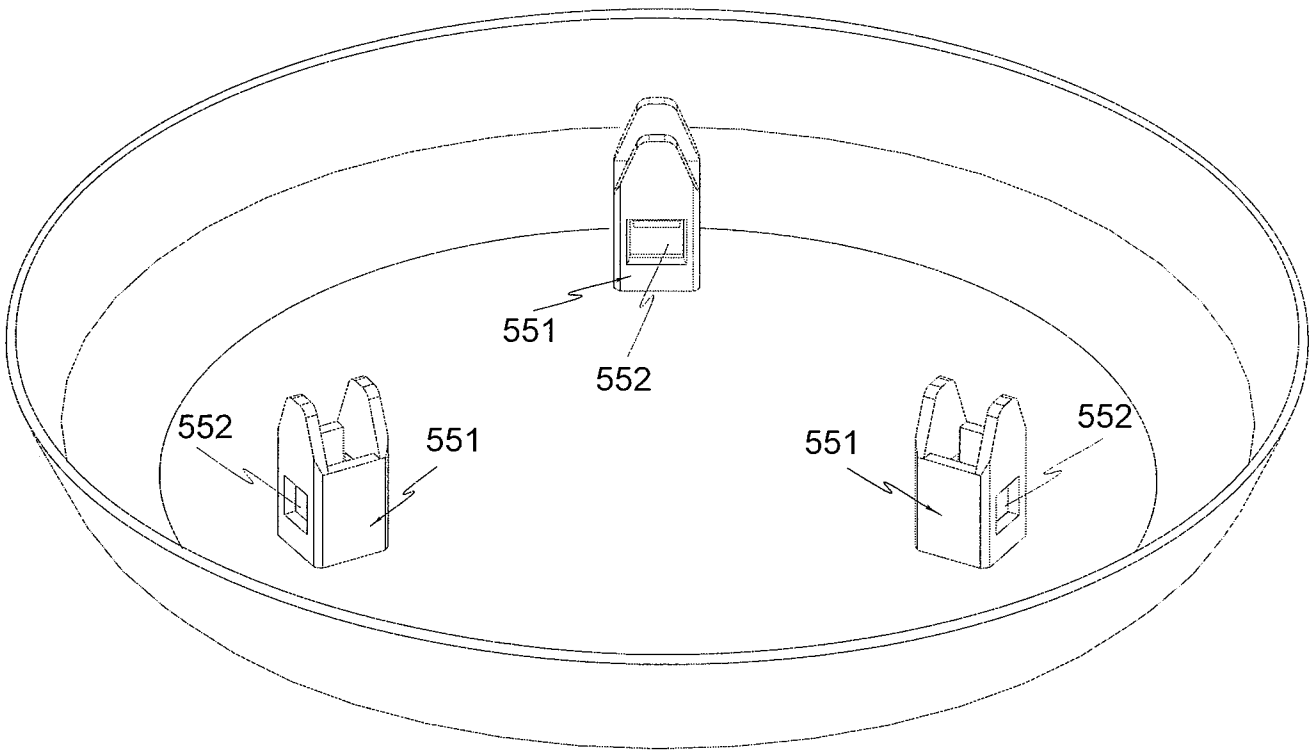


FIG. 33B



550

FIG. 34

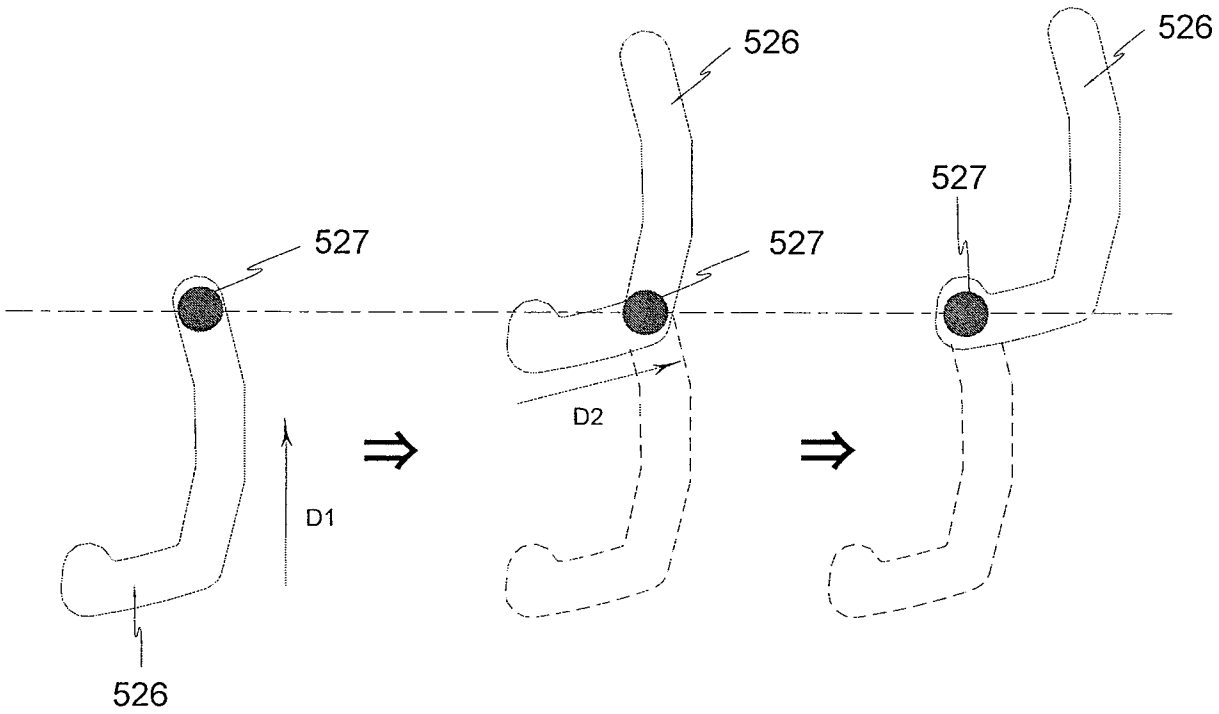


FIG. 35

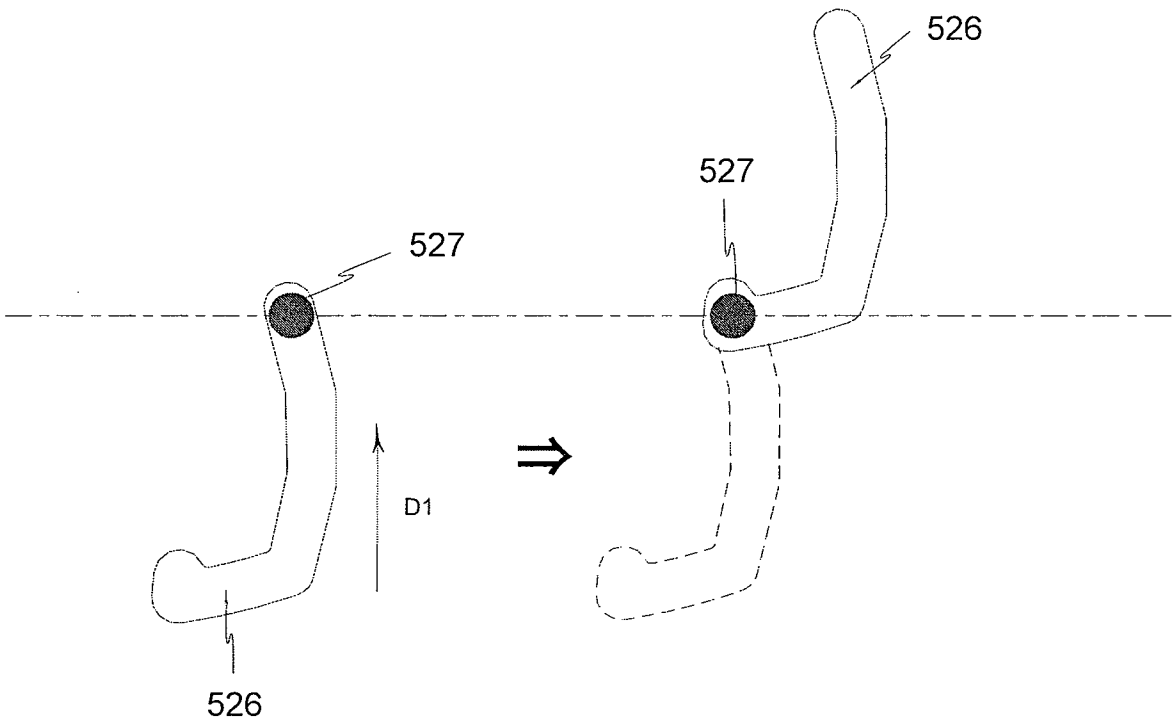


FIG. 36

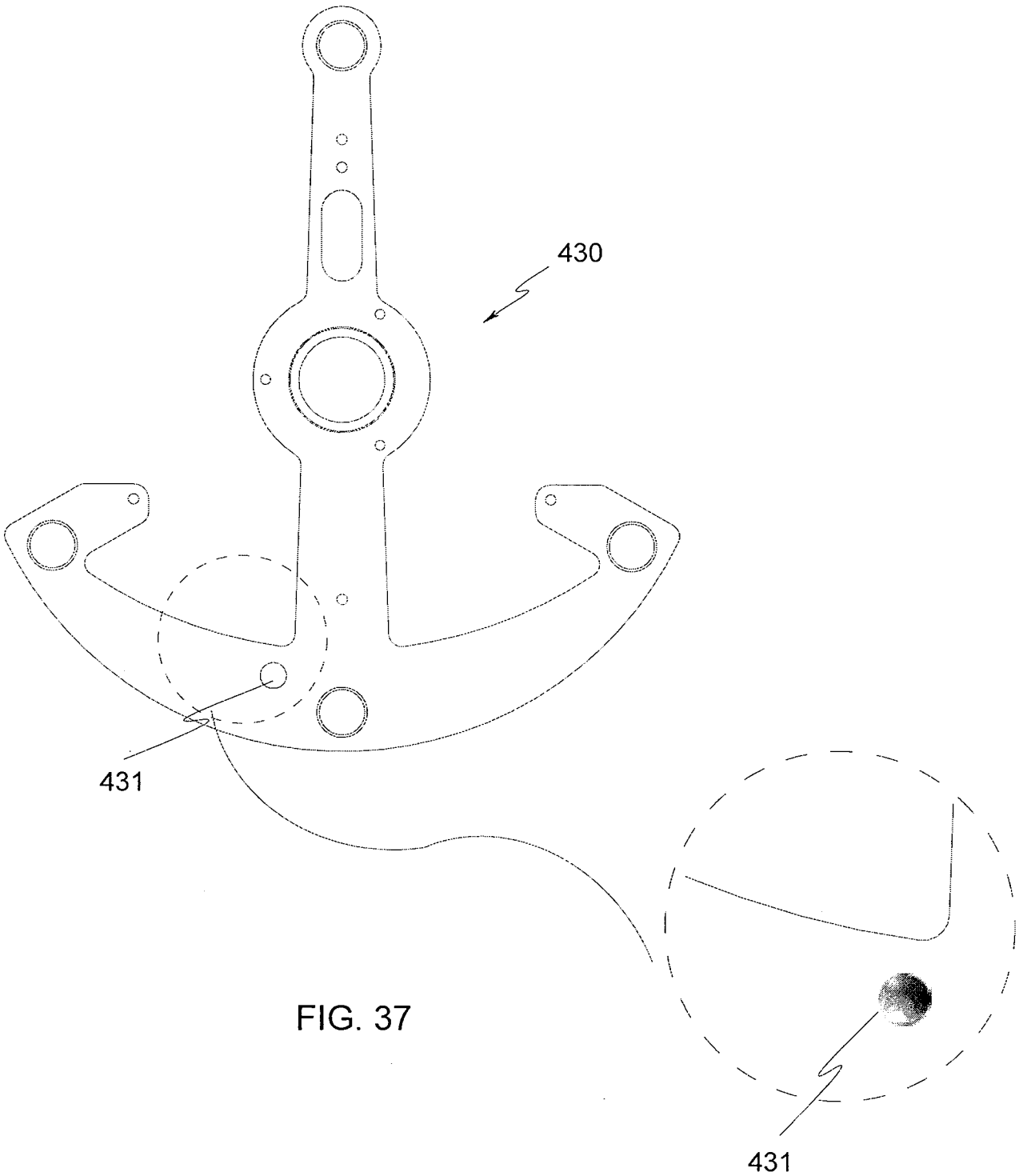
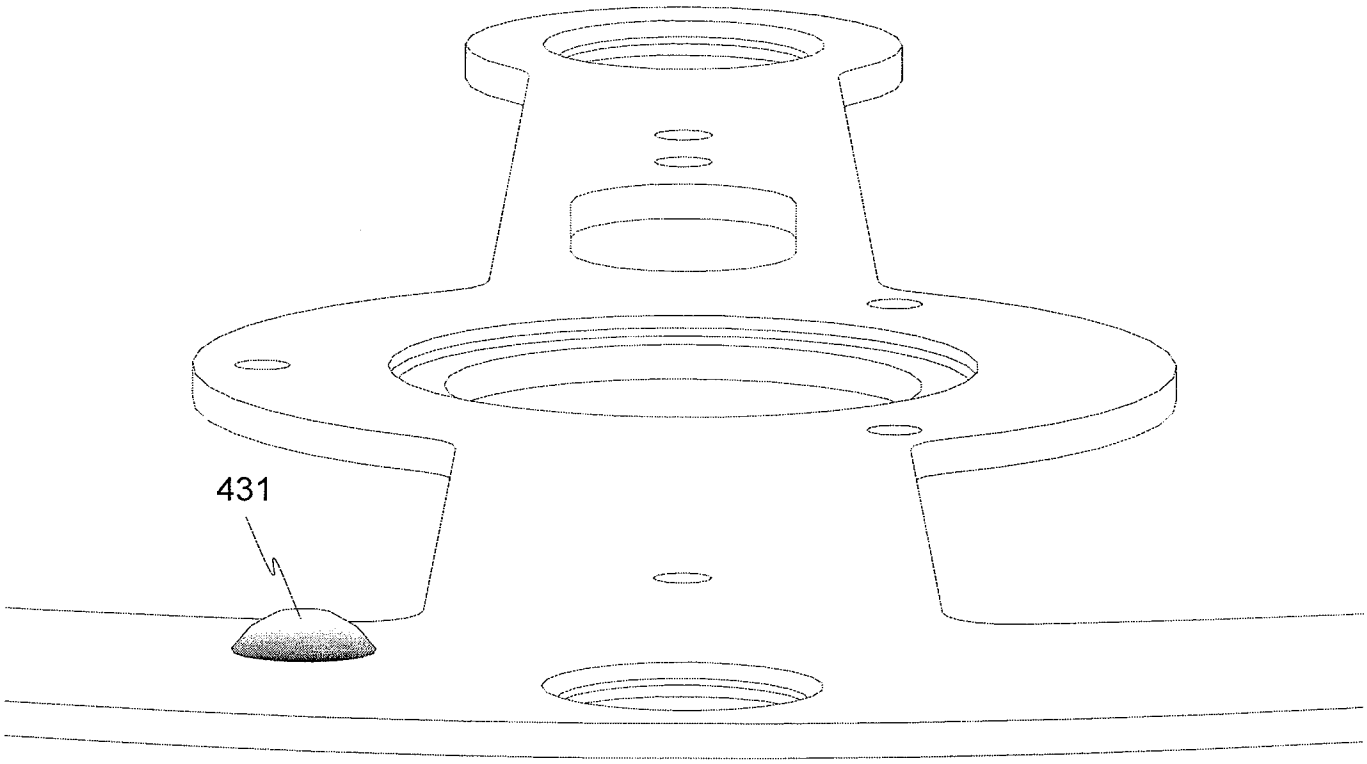


FIG. 37



430

FIG. 38

FIG. 39A

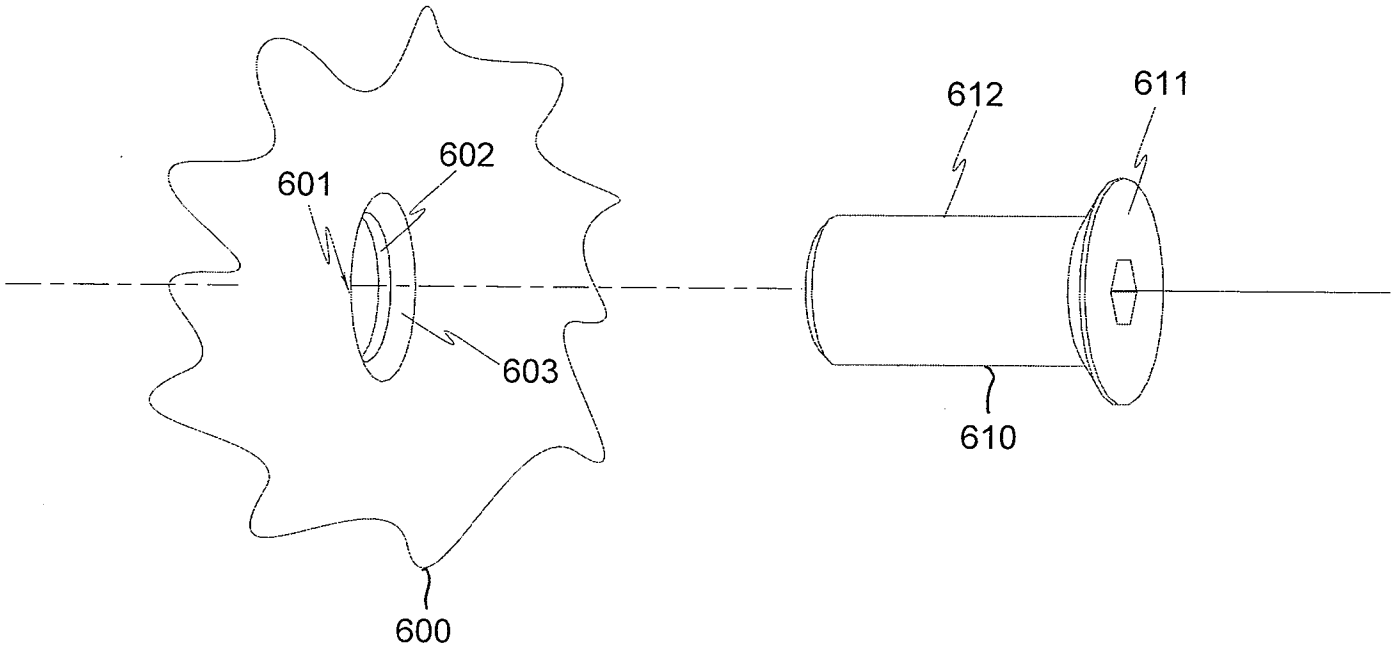
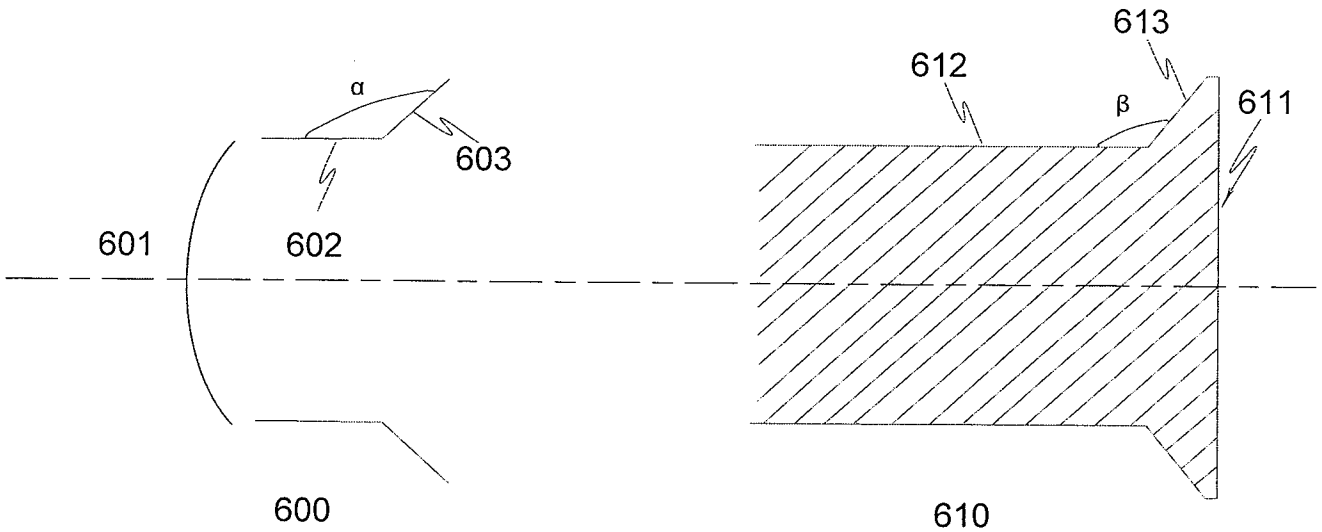


FIG. 39B



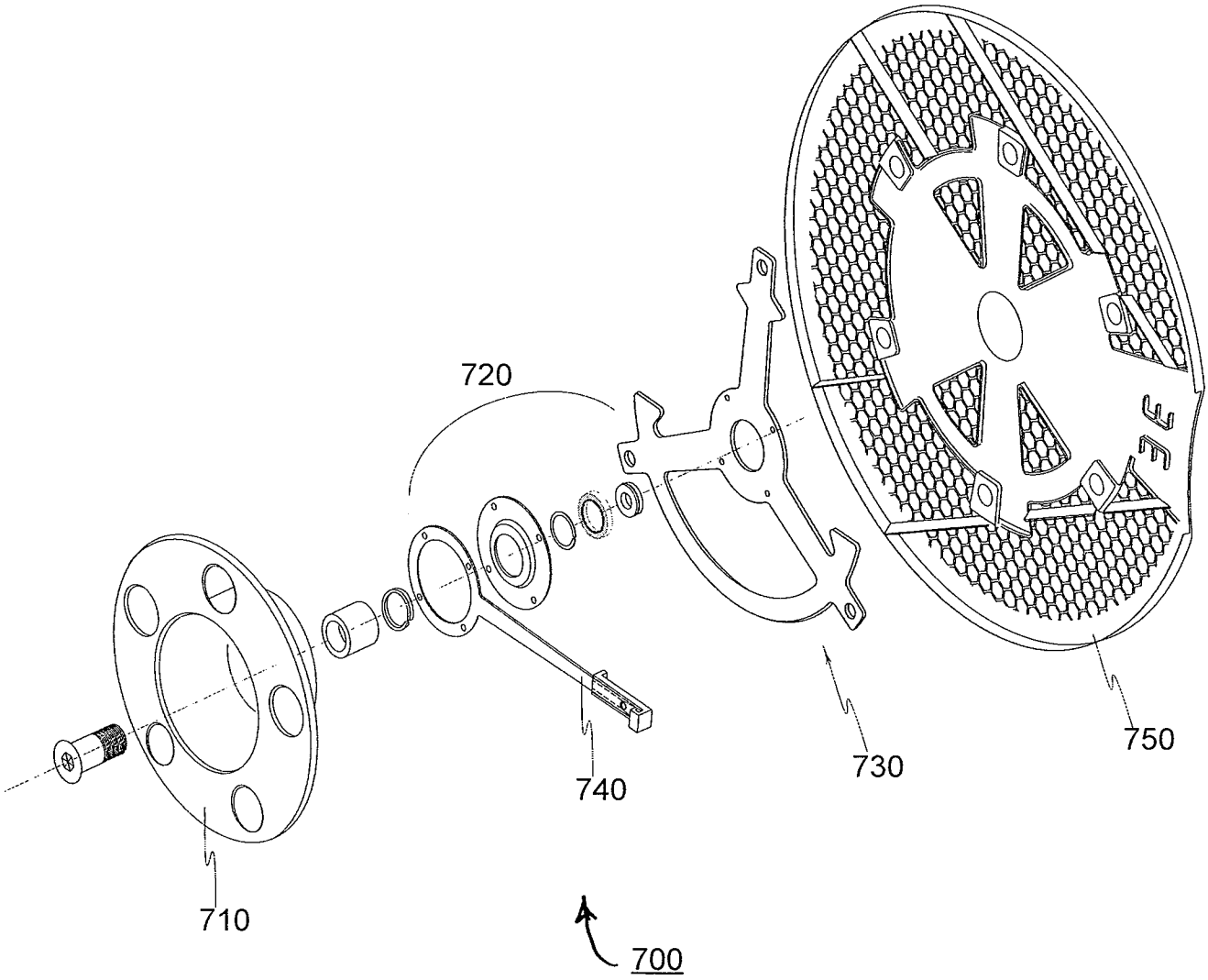


FIG. 40

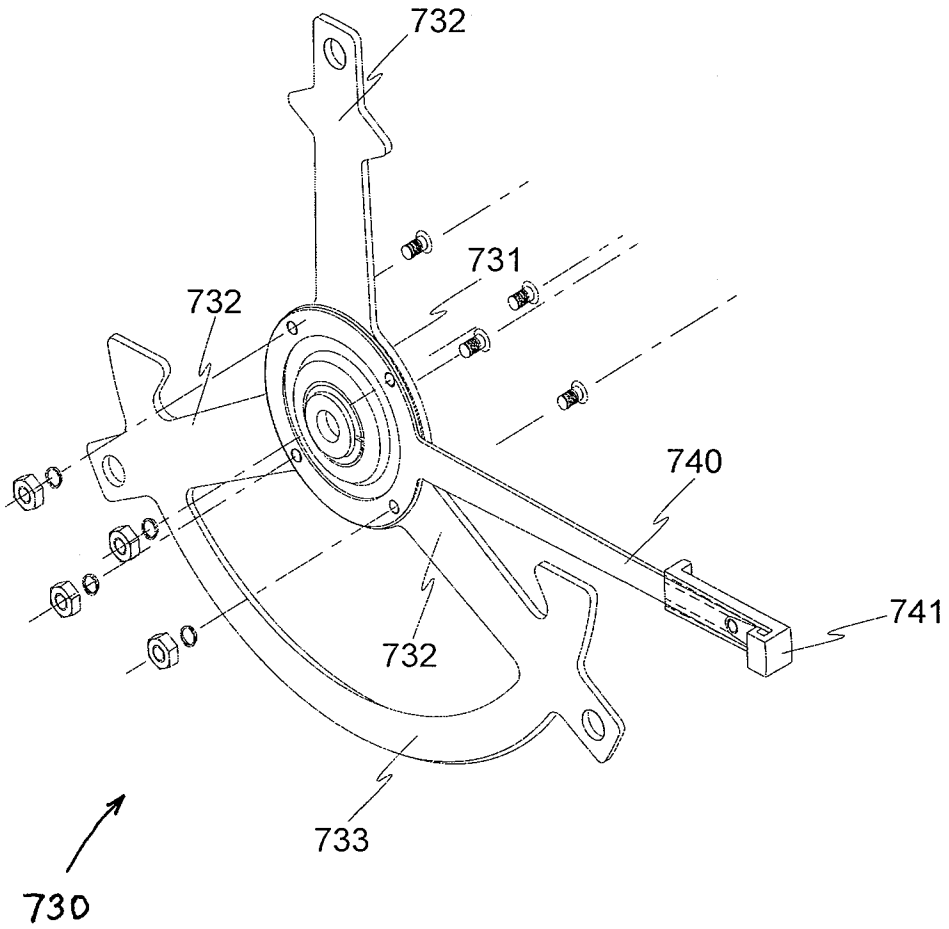


FIG. 41

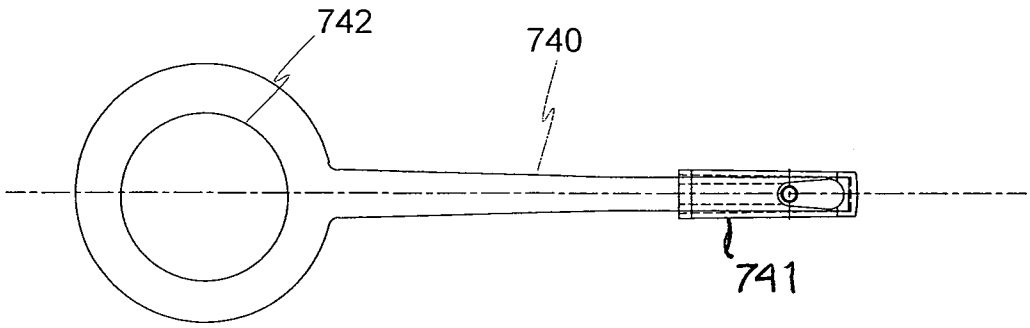


FIG. 42A

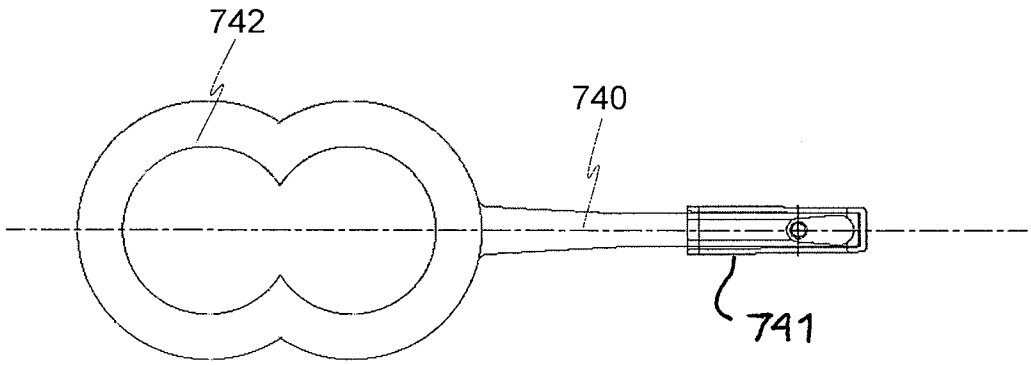


FIG. 42B

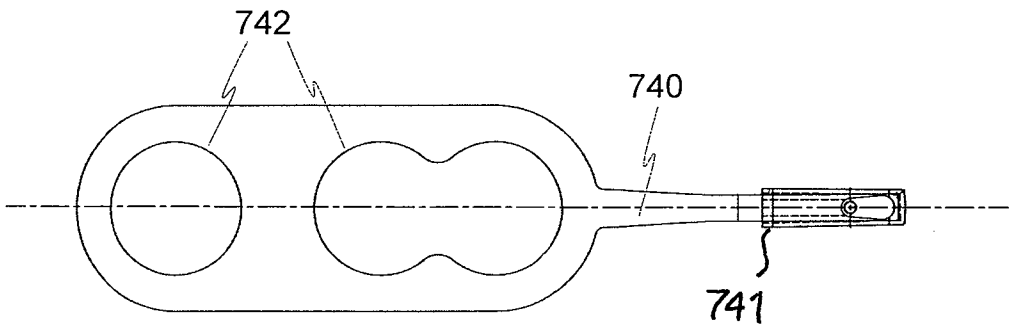


FIG. 42C