

Published:

- *with international search report (Art. 21(3))*
- *in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE*

PUSH-TO-PULL CONVERTIBLE CARRIAGE

TECHNICAL FIELD

5 **[0001]** The present disclosure relates generally to a human-propelled carriage, and more particularly to a hands-free pull-behind carriage that is convertible to a carriage that is pushed by hand.

BACKGROUND

10 **[0002]** Hands-free pulling systems exist that connect pull-behind carriages to a person's waist or torso. Such carriages typically have two wheels, in contrast to the three or four wheels of, for example, a conventional stroller that is pushed by hand.

[0003] PCT publication WO2017/044984 to Hanson discloses a convertible stroller having a main carriage and a handle bar assembly, wherein the handle bar assembly is
15 configured to convert between push and pull configurations to enable a user to either push or pull the stroller.

[0004] US patent 6196572 to Durrin discloses a convertible trailer and stroller. An upper bar converts from a handle bar position to a roll bar position. The handle bar position provides a push or pull point in the stroller configuration, while the roll bar
20 position operates in the trailer configuration to provide protection to a passenger.

[0005] US patent 9669859 to Hansen discloses a stroller that converts to a bicycle trailer. The push handle pivots between a stroller position and a trailer position. Movement of the push handle to the trailer position causes a front wheel to move to a stowed position.

25 **[0006]** US patent 9434401 to the present inventor discloses a harness and pulling assembly for a pull-behind jogging stroller.

[0007] This background information is provided to reveal information believed by the applicant to be of possible relevance to the present invention. No admission is necessarily intended, nor should be construed, that any of the preceding information
30 constitutes prior art against the present invention.

SUMMARY OF INVENTION

[0008] A pull-behind carriage has an auxiliary wheel mounted on a reconfigurable
5 drawbar. When the pull-behind carriage is converted to a push carriage, the drawbar is
reconfigured so that the auxiliary wheel is positioned on the ground to act as an extra,
supporting wheel. The drawbar is adjustable from an extended configuration in the pull-
behind mode to a folded configuration in the push mode. The drawbar may also serve
10 to move the axle of the main wheels backward when the carriage is converted from the
pull-behind mode to the push mode, and vice versa. Hinge joints in the drawbar are
unlockable by pressing a palm button, which does not need to be kept pressed as the
drawbar is moved through the majority of its range from one configuration to the other.

[0009] An advantage of the present invention is that the convertible carriage can be
15 pulled to a grocery store, for example, when in a first, pull-behind configuration, and
then pushed around inside the grocery store when in a second, push configuration.

[0010] Disclosed herein is a convertible carriage comprising a body, two rear wheels
supporting the body, a foldable drawbar connected to the body, and an auxiliary wheel
mounted on the drawbar, wherein, when the drawbar is folded, the auxiliary wheel
supports the carriage.

20 **[0011]** In some embodiments, an end of the drawbar distal from the body is attachable
to the body when the drawbar is folded. When the drawbar is extended and the carriage
is in the level orientation, the auxiliary wheel is above ground level.

[0012] In some embodiments, the two rear wheels are adjustable from a first position
25 behind the centre of gravity of the carriage when the drawbar is folded and the carriage
in a level orientation, to a second position forward of the first position relative to the
body when the drawbar is extended and the carriage is in the level orientation, wherein
the second position is selectable such that when the drawbar is extended and the
carriage is loaded and in the level orientation, the center of gravity of the loaded
carriage is above an axle joining the rear wheels.

[0013] In some embodiments, the drawbar comprises a first hinge joint and a second hinge joint located further from the body than the first hinge joint when the drawbar is extended, wherein the auxiliary wheel is located at the second hinge joint.

[0014] In some embodiments, each hinge joint comprises: a palm button; a first arm
5 connected to a first member of the drawbar; a clutch plate rotationally fixed relative to the first arm; a second arm connected to a second member of the drawbar; a translating clutch plate rotationally fixed relative to the second arm, wherein, when the palm button is pressed, the translating clutch plate is translated away from the clutch plate without translating the second arm; a spring that biases the translating clutch plate
10 towards the clutch plate; and range restricting features on the clutch plate and translating clutch plate that prevent the clutch plate and translating clutch plate locking with each other over a first range of angles between a first angle corresponding to the extended drawbar and a second angle corresponding to the folded drawbar.

[0015] Also disclosed is a method for converting a carriage from a pull-behind
15 configuration to a push configuration, the carriage having a body, two rear wheels supporting the body, a foldable drawbar connected to the body, and an auxiliary wheel mounted on the drawbar; the method comprising: unlocking one or more hinge joints in the drawbar; folding a distal end of the drawbar downwards so that the auxiliary wheel supports the carriage; unlocking a proximal end of the drawbar from the body; moving
20 the proximal end of the drawbar rearward relative to the body, thereby moving the rear wheels rearward relative to the body.

[0016] Further disclosed is a method for converting a carriage from a push
configuration to a pull-behind configuration, the carriage having a body, two rear wheels supporting the body, a foldable drawbar connected to the body, and an auxiliary wheel
25 mounted on the drawbar; the method comprising: releasing a distal end of the drawbar from the body; extending the distal end of the drawbar upwards so that the auxiliary wheel is above ground level when the carriage is in a level orientation; locking at least one hinge joint in the drawbar; and moving a proximal end of the drawbar forward relative to the body, thereby moving the rear wheels forward relative to the body.

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BRIEF DESCRIPTION OF DRAWINGS

[0017] The following drawings illustrate embodiments of the invention, which should not be construed as restricting the scope of the invention in any way.

5 **[0018]** FIG. 1 is a side view of a person pulling a convertible carriage in the pull-behind configuration, according to an embodiment of the present invention.

[0019] FIG. 2 is a side view of the convertible carriage of FIG. 1 in the push configuration.

10 **[0020]** FIG. 3 is a perspective view of the convertible carriage of FIG. 1 in the push configuration.

[0021] FIG. 4 is a side view of the convertible carriage of FIG. 1 in the pull-behind configuration without the rear wheels.

[0022] FIG. 5 is a side view of the convertible carriage of FIG. 1 in the push configuration without the rear wheels.

15 **[0023]** FIG. 6 is a perspective view of a wheel and fender subassembly removed from the carriage.

[0024] FIG. 7 is a perspective view of the outer end of the drawbar and the harness, disconnected from each other.

20 **[0025]** FIG. 8 is a perspective view of the outer end of the drawbar and the harness, connected to each other.

[0026] FIG. 9 is a perspective view of the convertible carriage in a fully folded configuration, without the wheel and fender subassemblies.

25 **[0027]** FIG. 10 is a method for converting a convertible carriage from a pull-behind configuration to a push configuration, according to an embodiment of the present invention.

[0028] FIG. 11 is a method for converting a convertible carriage from a push configuration to a pull-behind configuration, according to an embodiment of the present invention.

[0029] FIG. 12 is a front view of an example of a folded drawbar joint, according to an
5 embodiment of the present invention.

[0030] FIG. 13 is a front view of the joint of FIG. 12 shown in an extended position.

[0031] FIG. 14 is the non-translating clutch plate of the joint of FIG. 12.

[0032] FIG. 15 is the translating clutch plate of the joint of FIG. 12.

[0033] FIG. 16 is an exploded perspective view of the joint of FIG. 12, seen from the
10 rear.

[0034] FIG. 17 is an exploded front perspective view of the joint of FIG. 12, seen from the front.

[0035] FIG. 18 is an exploded perspective view of an alternate joint seen from the rear, according to an embodiment of the present invention.

[0036] FIG. 19 is an exploded perspective view of the joint of FIG. 18, seen from the
15 front.

DESCRIPTION

A. Exemplary Embodiments

[0037] FIG. 1 illustrates an exemplary embodiment of a convertible carriage 10 in its
20 pull-behind configuration attached to a harness 12 worn by a person 14. The person 14 is pulling or towing the convertible carriage 10 hands-free because the harness 12 is coupled to the person's waist or around the person's hip bones, where it can be
25 tightened without restricting breathing. The person 14 can pull the convertible carriage 10 while doing daily activities such as child care, going to a grocery store, or running for exercise.

[0038] The carriage 10 is a wheeled conveyance, cart or trailer to be pushed or pulled by the person 14. The carriage 10 can be a two-wheeled rickshaw-type carriage, which can be a stroller such as a walking, jogging, or running stroller for carrying one or more children or animals or for carrying various goods. One such embodiment might be for
5 cross-country runners who use it to convey camping equipment. The carriage 10 has two main or rear wheels 20, 22 that rotate about a common axle 24. The axle 24 for the wheels 20, 22 is adjustable forward and rearward with respect to the rest of the carriage 10. This is so that a person 14 using the carriage can balance the weight of the carriage and any load held within the carriage over the axle, or sufficiently close to the axle that
10 the average upward or downward force on the harness 12 is within a comfortable range for the person. The weight of the carriage 10 can be balanced over the axle 24, or the carriage can be designed such that with a load in the carriage, the combined weight of the carriage and the load is balanced over the axle. Fenders 26 are present over the upper portions of the main wheels 20, 22.

[0039] The carriage 10 has a frame 30 that supports a seat 32 for a baby, toddler or child. The frame 30 and seat 32 can be considered to be the body 33 of the carriage. Just visible in this view is the footrest 34. The carriage 10 has an adjustable and/or removable hood 36. Also present is a handle 38 for use when the carriage is in the push configuration. As the handle 38 is not needed when the carriage 10 is in the pull-
20 behind configuration, it is folded downward from the frame 30 at hinge 40. The hinge 40 includes a locking mechanism to retain the handle 38 in the folded-down position so that it does not flap back and forth when the carriage 10 is being pulled by the person 14.

[0040] The carriage 10 includes a drawbar 50, which, at its forward end 51 distal from
25 the body 33, is connected to leaf spring 52. A drawbar is typically a rigid rod above ground level attached to a wheeled carriage, for pulling it either by hand or by a vehicle. The leaf spring is inserted into connector 56 that forms part of the harness 12. Around the leaf spring 52 is a molded grip 54 to help the user insert the leaf spring into the connector 56. The molding 54 is flexible and is made, for example, from a rubber-like
30 material that feels soft to the touch when held. The molding 54 is slid over the leaf spring 52 and then bonded in place.

[0041] The leaf spring 52 projects forward out of the grip 54 to form a tongue (not visible), which is inserted into the connector 56. The outermost end of the leaf spring 52 is notched so that it can be retained inside the connector 56. The connection mechanism may be, for example, similar to the mechanism for attaching a seatbelt in a car. A hook 59 is present on the connector 56, which is used to pull out a spring plunger that extends through or into the notch of the leaf spring 52 when the leaf spring is in the connector 56.

[0042] The free length of the leaf spring 52, between the forward end 51 of the drawbar 50 and the rearward end 57 of the connector 54, is adjustable. Plunger pin 58 can be retracted to loosen the leaf spring 52 such that it can slide back and forth in the end 51 of the drawbar 50. When the leaf spring 52 has been adjusted to the desired position, the plunger pin 58 is returned to secure the leaf spring in place. The free length of the spring 52 is adjustable to control its stiffness, in order to tune a resonant frequency of the carriage 10 away from a frequency of a gait of the person 14.

[0043] The drawbar 50 is rigid when the carriage 10 is set in its pull-behind configuration. It is especially important for the drawbar 50 to be rigid in this configuration for proper functioning of the carriage. The drawbar 50 includes an inner member 60 attached at its lower end to the body of the carriage and at its upper end to arm 62 of hinge 64 or other equivalent joint. The other arm 66 of hinge 64 is connected to the middle member 68 of the drawbar 50. The hinge is lockable by tightening knob 70, which allows the inner member 60 and middle member 68 of the drawbar 50 to be locked at different angles to each other. When the carriage 10 is in the pull-behind configuration, the inner member 60 and middle member 68 are locked in an extended configuration. By locking the two members 60, 68 in position relative to each other, the rigidity of the drawbar 50 is maintained. Instead of knob 70, a cam lever may be used in other embodiments, similar to the quick-release locking mechanism on many bicycle axles. In other embodiments, other locking mechanisms are also possible.

[0044] The middle member 68 of the drawbar 50 is attached to arm 80 of hinge 82 or other equivalent joint. The other arm 84 of the hinge 82 forms, or is connected to, the outer member 85 of the drawbar 50. In some embodiments, items 84 and 85 are the same piece, i.e. of unitary construction or monolithic. The hinge 82 is lockable by

tightening knob 86, which allows the middle member 68 and outer member 85 of the drawbar 50 to be locked at different angles to each other. When the carriage 10 is in the pull-behind configuration, the middle member 68 and outer member 85 are locked in an extended configuration. By locking the two members 68, 85 in position relative to
5 each other, the rigidity of the drawbar 50 is maintained.

[0045] Components of the drawbar 50 are formed from a rigid material such as carbon fiber, wood, plastics, or metals such as tubes of steel, aluminum, titanium or their alloys. Depending on the embodiment, the drawbar 50 can have an overall length between 0.6-1.5m, for example.

10 **[0046]** Hinge 82 and outer member 85 form a variable angle bracket, which is used to adjust the angle at which the outer member and leaf spring 52 attach to the harness 12. This is useful to accommodate the fit of the carriage 10 to persons of different height. As well, the angle between the inner member 60 and middle member 68 can be
15 adjusted to accommodate the fit of the carriage 10 to the person 14. As another example, the angle at which the outer member 85 and leaf spring 52 attach to the harness 12 can be selected or optimized such that effects of a vertical component of the periodic or cyclic motions of the person 14 are canceled or offset, or at least partially canceled or offset, by effects of a horizontal component of the periodic or cyclic motions of the person.

20 **[0047]** A third or auxiliary wheel 88 is mounted on the drawbar 50 and serves as a third road wheel or supporting wheel when the carriage is in the push configuration. The auxiliary wheel 88 is mounted at or near the hinge 82. In the example shown, the auxiliary wheel 88 is mounted coaxially with the center of rotation of the hinge 82. The auxiliary wheel is not used when the carriage 10 is in the pull-behind configuration. It is
25 therefore advantageous for the auxiliary wheel 88 to be lightweight and small if it is desired to keep the overall load pulled by the person 14 as low as possible.

[0048] When the carriage 10 is in normal use, either when being pulled or pushed, it is considered to be in a level orientation relative to the ground 90. A level orientation includes tilting of different amounts depending on the settings of the hinges 64, 82 and
30 the height of the person 14, the only requirement being that when the carriage is

attached to a person 14 by a harness 12, the auxiliary wheel 88 is above ground level 90.

[0049] Referring to FIG. 2, the carriage is shown in a level orientation in the push configuration, with the auxiliary wheel 88 and both main wheels 20, 22 on the ground
5 90 and supporting the carriage. The handle 38 has been extended upward about hinge 40 and locked into position. The height of the handle 38 can be adjusted to suit the person pushing the carriage 10 by setting the angle of hinge 40 as desired.

[0050] The drawbar 50 is also rigid when the carriage 10 is set in its push configuration. The drawbar 50 has been folded at hinge 64 by loosening knob 70 and
10 moving the middle member 68 downward and inward towards inner member 60. The drawbar 50 has also been folded at hinge 82 by loosening knob 86 and moving the outer member 85 inward towards the body of the carriage 10. The end of the leaf spring 52 has been removed from the harness 12 and attached to a connector 91, which is mounted on the body of the carriage 10. When the leaf spring 52 is attached to the
15 connector 91, tightening of the knobs 70, 86 is optional. However, one reason to tighten them would be to stop potential rattling. When the carriage 10 is in the push configuration, the inner member 60, middle member 68 and outer member 85 are in this folded configuration.

[0051] When the carriage 10 is reconfigured from the pull-behind configuration to the
20 push configuration, the main wheels 20, 22 are moved backward relative to the frame 30 of the carriage. As can be seen, the footrest 34 is more visible in this configuration than in FIG. 1 as it has been exposed more by the rearward displacement of the main wheels 20, 22. The main wheels 20, 22 are moved rearward in order to position them sufficiently behind the center of gravity of the carriage 10 so that the carriage is stable
25 and will not topple over when freestanding in the push configuration. To move the main wheels 20, 22 rearward, handle 92 is lifted against the force of a spring, which results in a locating pin (not shown) connected to the handle being lifted out of a corresponding locating hole (not shown) in the top of the inner member 60 of the drawbar 50. The inner member 60, to which the axle 24 is connected, is then free to slide backwards
30 relative to the rest of the carriage 10. When the inner member 60 is in the desired position, the handle 92 is released, causing the locating pin to spring into another

locating hole in the inner member 60. This locks the axle 24 of the main wheels 20, 22 in a suitable position relative to the frame 30 for the carriage 10 to be used safely in the push configuration. There may be several different locating holes in the inner member 60, each one matched to a different weight and/or size of the load that is carried by the carriage 10. In other embodiments, alternate locking mechanisms may be used to move the wheels relative to the drawbar and to lock them in place.

[0052] FIG. 3 shows guide 94 in which is located the end of the inner member 60 of the drawbar 50 that is proximal to the body 33. Guide 94 is mounted to frame 30 of the carriage 10. When handle 92 is lifted, the inner member 60 can slide freely through the guide 94.

[0053] FIG. 4 shows the carriage 10 in the pull-behind configuration, without the main wheels for clarity. The axle 24, for the main wheels, supports struts 102 to left and right sides of the seat 32, the struts in turn supporting the frame 30 of the carriage 10. The struts 102 are connected pivotally at their ends, i.e. at axle 24 at their lower ends and at pivot points 104 at their upper ends. In the pull-behind configuration, the inner member 60 and axle 24 are positioned in a forward location relative to the frame 30 and seat 32 of the carriage 10, i.e. further forward than when the carriage is in the push mode. As such, the axle 24 is approximately aligned with what would be the center of gravity (COG) of the carriage when loaded. When the carriage loaded with a child is pulled by a person running, it works best if the drawbar weight on the runner is zero, i.e. the vertical force on the runner is neutral. As the axle position moves toward the COG of the combined stroller and child, the drawbar weight approaches neutral, and the stroller provides its best performance.

[0054] Projection 108 is a locating feature for locating the fender 26. Projection 109 is a parking brake, and there is one on each wheel.

[0055] The drawbar 50 serves the dual purpose of pulling the carriage when it is in its pull-behind configuration, and adjusting the position of the axle for the main wheels.

[0056] FIG. 5 shows the carriage 10 in the push configuration, without the main wheels for clarity. In the push configuration, the inner member 60 and axle 24 are positioned in a rearward location relative to the frame 30 and seat 32 of the carriage 10,

i.e. further backward than when the carriage is in the pull-behind mode. Note that the struts 102 have been swung backward compared to their position in FIG. 4. In the push configuration, the axle 24 is in behind what would be the center of gravity (COG) of the loaded carriage by a distance D.

5 **[0057]** Referring to FIG. 6, each main wheel 22 with its corresponding fender 26 is removable as a unit. When replacing the wheel-fender subassembly, locating features on the fender such as hole 110 and on the frame of the carriage, such as corresponding projection 108, are present to allow the fender to be positioned correctly at its intended angular location. The connection between the wheel and the frame of
10 the carriage can use any mechanism that is commonly found in existing strollers.

[0058] FIG. 7 shows the outer member 85 of the drawbar 50 and leaf spring 52 disconnected from the harness 12. Outer end 112 of the leaf spring 52 is visible projecting through the grip 54. The outer end 112 forms a tongue that acts as the male connecting component that mates with connector 56, the female component. In some
15 embodiments, the leaf spring is permanently fixed to the end 85 of the drawbar and terminates at its other end within the grip 54. The exposed length of the leaf spring is then adjusted by varying the insertion depth of the spring into the grip 54. The tongue 112 in this embodiment is then a separate piece of metal.

[0059] A notch 114 or other connector in the outer end 112 of the leaf spring 52 is
20 used to secure the leaf spring to the connector 56. Hook 59 pulls out a spring plunger that passes into or through the notch 114 in order to secure the end 112 of the leaf spring 52 in the connector 56. The connector 56 can swivel sideways and up and down on a mount 117 of the harness 12. FIG. 8 shows end 112 of the leaf spring 52 inserted into the connector 56.

25 **[0060]** The carriage 10 is designed to allow for compact storage. Referring to FIG. 9, the carriage in its completely folded configuration is shown, with the wheels and fenders removed. In this configuration the carriage can be stowed in a car trunk, for example. The outer member 85 of the drawbar and leaf spring 52 are completely folded over onto the middle member 68 via hinge 82. The middle member 68 is completely folded over
30 onto the inner member 60 via hinge 64. Inner member 60 is folded onto or into the frame 30 or seat 32. Also, the handle 38 is folded downwards. Locating projection 108

for the fender is visible in this view. Push-pins 118 are also visible that release the telescoping struts 102, allowing them to lengthen as the carriage is transitioned into the completely folded configuration shown. The struts remain in their shortened configuration for both the pull-behind and push configurations of the carriage. In some
5 embodiments, the wheel and fender subassemblies are dimensioned so that they fit in the seat 32 to either side of the folded drawbar, for example for storage or transport of the carriage.

B. Method

[0061] FIG. 10 relates to the steps of an exemplary method for converting a
10 convertible carriage from a pull-behind mode to a push mode. In step 120, the hinges 64, 82 in the drawbar 50 are unlocked. In step 125, the drawbar is folded at the hinges 64, 82. In step 130, the end of the drawbar is attached to the frame 30 of the carriage via the leaf spring 52.

[0062] In step 132, the drawbar hinges 64, 82 are optionally re-locked. In step 135,
15 the handle 38 is unlocked. In step 140, the handle is raised and then locked in its raised position in step 145.

[0063] In step 150, the drawbar is unlocked from the frame of the carriage so that it is free to slide in the guide 94. In step 155, the drawbar is pushed backwards into the guide and then locked in position in step 160.

[0064] FIG. 11 relates to the steps of an exemplary method for converting the carriage
20 from a push mode to a pull-behind mode. In step 200, the handle 38 is unlocked, then lowered in step 205 and locked in position in step 210. In step 212, the drawbar hinges 64, 82 are unlocked if they were previously locked.

[0065] In step 215, the leaf spring 52 at the end of the drawbar is released from the
25 frame of the carriage. The drawbar is unfolded into its extended configuration in step 220, and the then hinges 64, 82 in the drawbar are locked in step 225.

[0066] In step 230, the inner member of the drawbar is unlocked from the guide 94. The drawbar is then pulled forward relative to the guide in step 235. In step 240, the inner member of the drawbar is locked into position.

C. Hinge Joints

[0067] FIG. 12 is an alternate, exemplary hinge joint 300 that can be used in the drawbar 50 in place of hinge 64. The hinge joint 300 has arms 302, 304 which connect to lower member 60 and middle member 68 of the drawbar 50. A palm button 306 is pushed inward towards the cap plate 308 to unlock the hinge joint so that the arms 302, 304 can be rotated relative to each other. When the arms 302, 304 have been moved to the new position, the palm button pops back out to lock the arms in the new position. If the palm button is then pressed again, and kept pressed, fine adjustments of the angular position of the hinge joint can be made. FIG. 13 shows the hinge joint 300 with the arms 302, 304 in an extended position. The palm button 306 is sitting proud of the cap plate 308, corresponding to the arms being locked.

[0068] Inside the hinge joint 300 there are two clutch plates, which are biased together with a spring, and when they are together they lock the arms at a desired angular position. When the palm button is pressed, the clutch plates come apart. Referring to FIGS. 14 and 15, the non-translating clutch plate 310 (or simply "clutch plate"), which is confined to rotate with the arm 302, and the translating clutch plate 320, which is confined to rotate with arm 304, are shown. The non-translating clutch plate 310 remains in position when the palm button 306 is pressed. The non-translating clutch plate 310 has teeth 312 for engaging with the teeth 322 of the translating clutch plate 320.

[0069] Bosses 316 project from the toothed side 314 of the non-translating clutch plate 310, for engaging with arced slots 326 in the toothed side 324 of the translating clutch plate 320. The bosses 316 engage with the slots over two limited angular ranges, one range corresponding to the drawbar 50 being extended and the other corresponding to the drawbar being folded. One of the limited angular ranges allows for some finer adjustment to match the height of the forward end of the drawbar to the size of the person 14 pulling the carriage. The other limited angular range is to allow for some finer adjustment when the drawbar is folded and moved rearward relative to the body of the carriage. When the angle of the joint is between the two ranges, the bosses 316 press against the surface 324 of the translating clutch plate 320, which prevents the teeth 312, 322 from engaging with each other. When the teeth are prevented from

engaging, the palm button may be released to free up the user's two hands for adjusting the angle of the drawbar members. A hole 318 through the centre of the non-translating clutch plate permits the inner portion of the palm button 306 to pass through so that it can push against boss 328 of the translating clutch plate 320, to disengage it
5 from the non-translating clutch plate 310.

[0070] A third range or single angle may be added in other embodiments, corresponding to the angular position of the joints when the carriage is in the stowage configuration.

[0071] FIGS. 16 and 17 are exploded views of hinge joint 300. Starting from the left,
10 shown is the palm button 306, with slots 330 that allow walls 331 to be squeezed together when the palm button is assembled into the hinge joint. Ridges 332 serve to press against the boss 328 of the translating clutch plate 320. Nut 334 receives bolt 360 to hold the joint together. Next there is the cap plate 308 and arm 302. The arm 302 has a hole 340 shaped to accommodate the non-translating clutch plate 310, to
15 effectively rotationally fix it to the arm, preventing relative angular movement between the arm and the clutch plate. Bearing 342 sits between the two arms 302, 304, and may be lightly lubricated. Translating clutch plate 320 sits in shaped hole 348 in the arm 304 so that they are rotationally fixed relative to each other and relative angular movement between them is prevented, even though the translating clutch plate can move along
20 the axis of the hinge joint within the arm 304. A boss 346 with a circular depression on the translating clutch plate 320 serves to locate coil spring 350, which is positioned around the bolt 360 and presses against the inner surface of a second cap plate 356. A washer 362 is used on the bolt 360.

[0072] FIGS. 18 and 19 are exploded views of an alternate hinge joint 400, which may
25 be used in the position of hinge 82. From the left, the hinge joint 400 includes bolt 401, washer 402, cap plate 404, coil spring 406, translating clutch plate 410 with arced slots 411 (FIG. 19) and arm 412. The arm 412 has a plate 414 that can be tightened onto the leaf spring 52 with bolt 416, to hold the leaf spring to the arm. Next is the auxiliary wheel 420, which rotates about the circular portions of the arms 412, 422 and also
30 serves as a bearing to the arms. The sliding surfaces of the wheel may be lightly lubricated. Arm 422 and non-translating clutch plate 424 are integral in this

embodiment. Bosses 426 on the non-translating clutch plate are shown. To the right there is a further end cap 430 with arced slots 431 for the walls 436 of the palm button 434, and then a nut 432 for holding the hinge joint together.

D. Variations

- 5 **[0073]** Other embodiments of the invention can have exactly three, exactly four, or more than four main wheels aligned to rotate about a common axle 24 or other common axis of rotation. It is also conceivable that some embodiments have exactly one, wide rear wheel, which is wide enough to prevent sideways toppling of the carriage.
- 10 **[0074]** The seat 32 may be made wider to accommodate two children, or two separate seats may be used. In some embodiments, the position of the axle 24 is fixed. In some embodiments, the mechanical connection of the carriage 10 to the harness 12 may employ different components, which are known.
- [0075]** In other embodiments the body 33 of the carriage may include a seat that is
15 integral with a frame, only a frame, only a seat, or another construction such as a box or flatbed for the carriage of goods.
- [0076]** Various known joints can be used to couple the body of the carriage 10 to the drawbar 50, the members 60, 68, 85 of the drawbar to each other, the outer member 85
20 to the spring 52, and the spring to the harness 12. Hinged joints in the drawbar can be constructed differently in other embodiments.
- [0077]** The carriage 10 can be designed to allow for even more compact storage. For example, one or more of the other components described herein can be telescoping or foldable so that they can be made more compact for storage. The carriage 10 can also be designed to be rapidly converted between the pull-behind and push configurations.
- 25 **[0078]** Other techniques may be used to permit the carriage to convert from a pull-behind configuration to a push configuration. For example, instead of using a hinge between the inner and middle members of the drawbar, the drawbar may be rotated from a curving upward configuration for pulling to a curving downward configuration for pushing. The drawbar may include further joints, compared to those illustrated, such

that when it is folded for the push configuration, it is more compact. One or more members of the drawbar may be telescoping. The auxiliary wheel may be located at a different position on the drawbar. The main requirement of the invention is that the carriage is convertible from a pull-behind carriage having one or more main wheels as the supporting wheels, to a push carriage that uses the main wheels and at least one auxiliary wheel as the supporting wheels.

[0079] Different known techniques may be used to allow the inner member 60 of the drawbar to move back and forth relative to the body of the carriage. In some embodiments the inner member of the drawbar may not move back and forth relative to the rest of the carriage, and instead, the axle for the main wheels is movable back and forth independently of the inner member.

[0080] In some implementations, the carriage 10 includes a plurality of drawbars 50 and/or a plurality of springs 52. In some implementations, the carriage 10 and/or the harness 12 can include a safety strap or other braking feature to prevent the carriage from rolling away from the person 14 if the drawbar 50 becomes disconnected from the carriage and/or the person, or if the person loses control of the carriage.

[0081] The auxiliary wheel may be made larger than shown, at the expense of introducing more weight to the drawbar. In some embodiments, more than one auxiliary wheel may be present.

[0082] The bosses 316 and arced slots 326 are examples of angular range restricting features. In other embodiments, other range restricting features may be used instead.

[0083] The auxiliary wheel may, in some embodiments, provide castor action.

[0084] Any of the components described herein can be fabricated from lightweight, rigid, and strong materials such as carbon fiber, plastics, or metals such as aluminum, steel, or titanium, or combinations of such materials.

[0085] In general, unless otherwise indicated, singular elements may be in the plural and vice versa with no loss of generality.

[0086] Throughout the description, specific details have been set forth in order to provide a more thorough understanding of the invention. However, the invention may be practiced without these particulars. In other instances, well known elements have not been shown or described in detail and repetitions of steps and features have been omitted to avoid unnecessarily obscuring the invention. Steps in the flowcharts may be performed in a different order to those shown. Accordingly, the specification and drawings are to be regarded in an illustrative, rather than a restrictive, sense. The various embodiments described above can be combined and modified to provide further embodiments. These and other changes can be made to the embodiments in light of the above-detailed description. All parameters, dimensions, materials, and configurations described herein are examples only and depend on the specific embodiment. Accordingly, the scope of the invention is to be construed in accordance with the following claims.

CLAIMS

1. A convertible carriage comprising:
a body;
5 two rear wheels supporting the body;
a foldable drawbar connected to the body; and
an auxiliary wheel mounted on the drawbar;
wherein, when the drawbar is folded, the auxiliary wheel supports the carriage.
- 10 2. The convertible carriage of claim 1, wherein an end of the drawbar distal from the body is attachable to the body when the drawbar is folded.
3. The convertible carriage of claim 1 wherein:
when the drawbar is folded, the auxiliary wheel supports the carriage in a level
15 orientation;
when the drawbar is extended and the carriage is in the level orientation, the auxiliary wheel is above ground level.
4. The convertible carriage of claim 3 wherein the drawbar is further foldable into a
20 stowage configuration.
5. The convertible carriage of claim 1, further comprising:
a connector attached to an end of the drawbar distal from the body, the
connector being adapted to connect to a harness that is worn by a person; and
25 a handle attached to the body for pushing the carriage, wherein the handle is lockable in a folded configuration when pulling the carriage.
6. The convertible carriage of claim 1, wherein the body comprises one or both of a
frame and a seat.
30
7. The convertible carriage of claim 1, further comprising:
a fender on each of the two rear wheels; and

locating features on the fenders and body to angularly position the fenders on the body;

wherein each rear wheel with its corresponding fender is detachable from the body as a subassembly.

5

8. The convertible carriage of claim 1, wherein the two rear wheels are adjustable from:

a first position behind the centre of gravity of the carriage when the drawbar is folded and the carriage in a level orientation; to

10 a second position forward of the first position relative to the body when the drawbar is extended and the carriage is in the level orientation;

wherein the second position is selectable such that when the drawbar is extended and the carriage is loaded and in the level orientation, the center of gravity of the loaded carriage is above an axle joining the rear wheels.

15

9. The convertible carriage of claim 1, wherein the drawbar comprises:

a first hinge joint; and

a second hinge joint located further from the body than the first hinge joint when the drawbar is extended;

20

wherein the auxiliary wheel is located at the second hinge joint.

10. The convertible carriage of claim 9, wherein each hinge joint comprises:

a palm button;

a first arm connected to a first member of the drawbar;

25

a clutch plate rotationally fixed relative to the first arm;

a second arm connected to a second member of the drawbar;

a translating clutch plate rotationally fixed relative to the second arm, wherein, when the palm button is pressed, the translating clutch plate is translated away from the clutch plate without translating the second arm;

30

a spring that biases the translating clutch plate towards the clutch plate; and

range restricting features on the clutch plate and translating clutch plate that prevent the clutch plate and translating clutch plate locking with each other over a first

range of angles between a first angle corresponding to the extended drawbar and a second angle corresponding to the folded drawbar.

11. The convertible carriage of claim 10, wherein the palm button does not need to
5 be pressed as the joint is moved through the first range of angles.

12. The convertible carriage of claim 10, wherein the range restricting features
permit the clutch plate and translating clutch plate to lock with each other over a second
10 range of angles corresponding to a range of settings of the extended drawbar and a
third range of angles corresponding to a range of settings of the folded drawbar.

13. The convertible carriage of claim 12, wherein the range restricting features
comprise:

15 a boss on one of the clutch plate and translating clutch plate; and
two arced slots on the other of the clutch plate and translating clutch plate;
wherein, when the boss is aligned with the arced slots, the clutch plate and
translating clutch plate can lock, and when the boss is not aligned with either of the
arced slots the clutch plate and translating clutch plate cannot lock.

20 14. A method for converting a carriage from a pull-behind configuration to a push
configuration, the carriage having a body, two rear wheels supporting the body, a
foldable drawbar connected to the body, and an auxiliary wheel mounted on the
drawbar; the method comprising:

25 unlocking one or more hinge joints in the drawbar;
folding a distal end of the drawbar downwards so that the auxiliary wheel
supports the carriage;
unlocking a proximal end of the drawbar from the body; and
moving the proximal end of the drawbar rearward relative to the body, thereby
30 moving the rear wheels rearward relative to the body.

15. A method for converting a carriage from a push configuration to a pull-behind
configuration, the carriage having a body, two rear wheels supporting the body, a

foldable drawbar connected to the body, and an auxiliary wheel mounted on the drawbar; the method comprising:

releasing a distal end of the drawbar from the body;

5 extending the distal end of the drawbar upwards so that the auxiliary wheel is above ground level when the carriage is in a level orientation;

locking at least one hinge joint in the drawbar; and

moving a proximal end of the drawbar forward relative to the body, thereby moving the rear wheels forward relative to the body.

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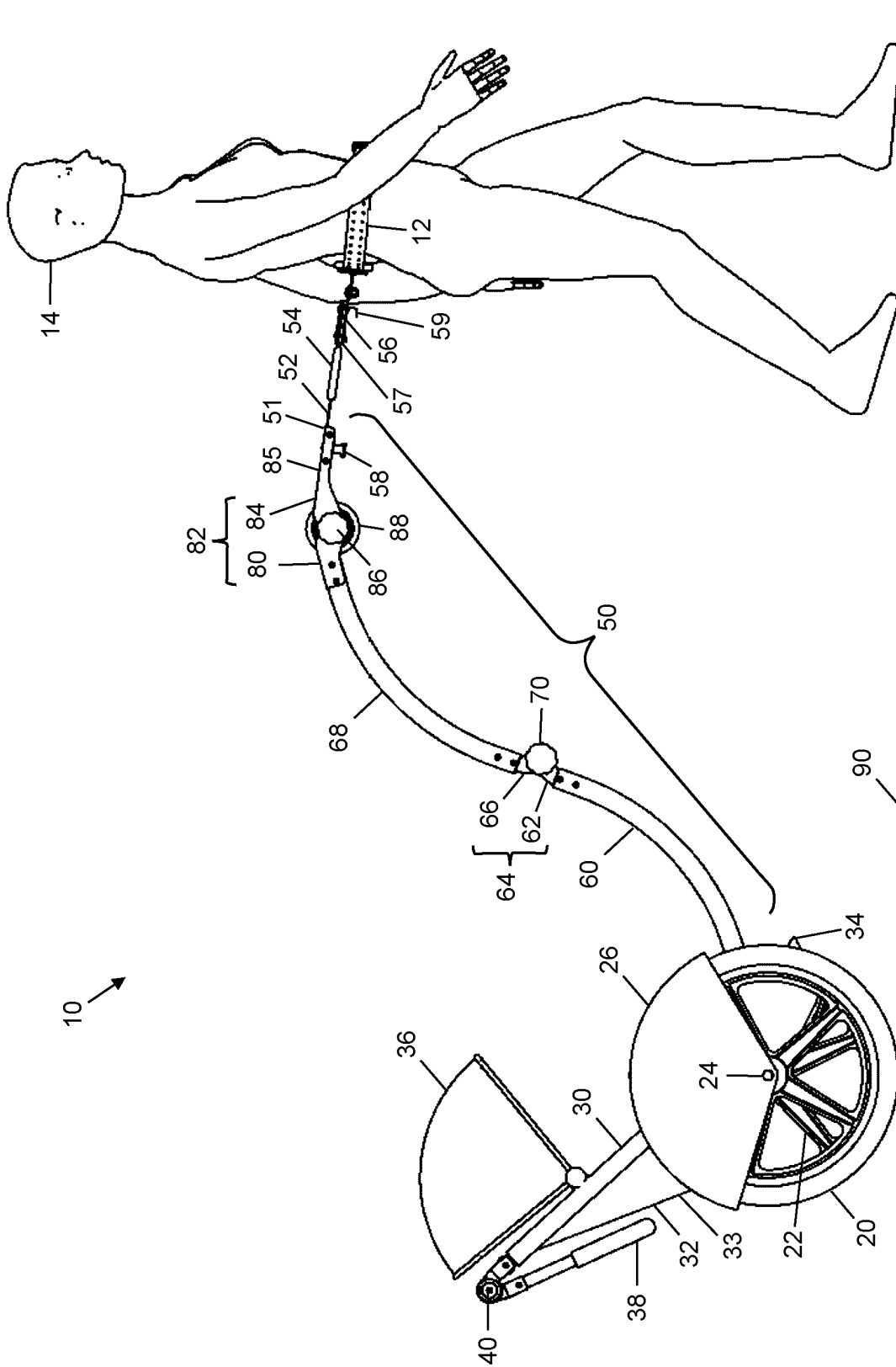


FIG. 1

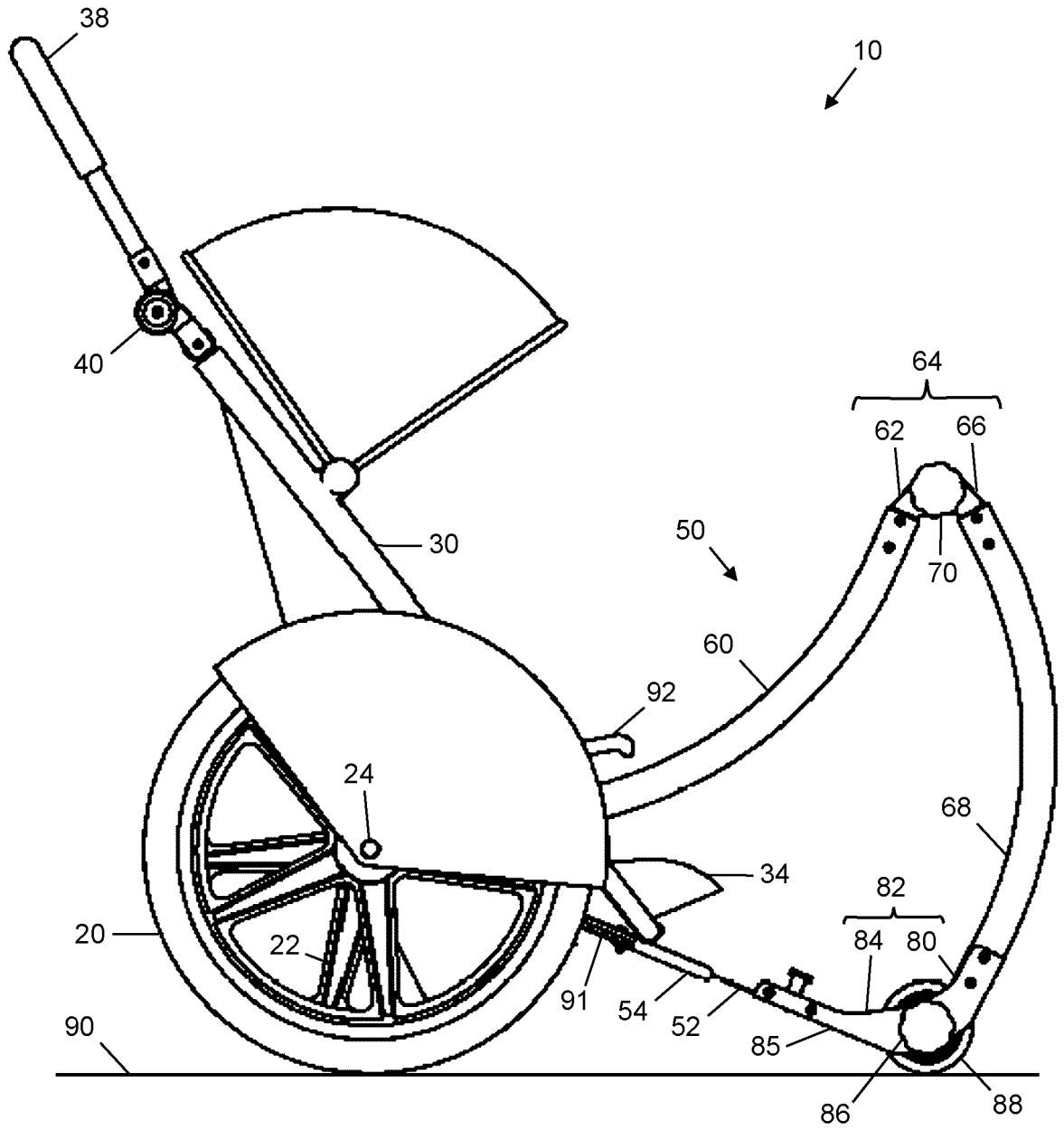


FIG. 2

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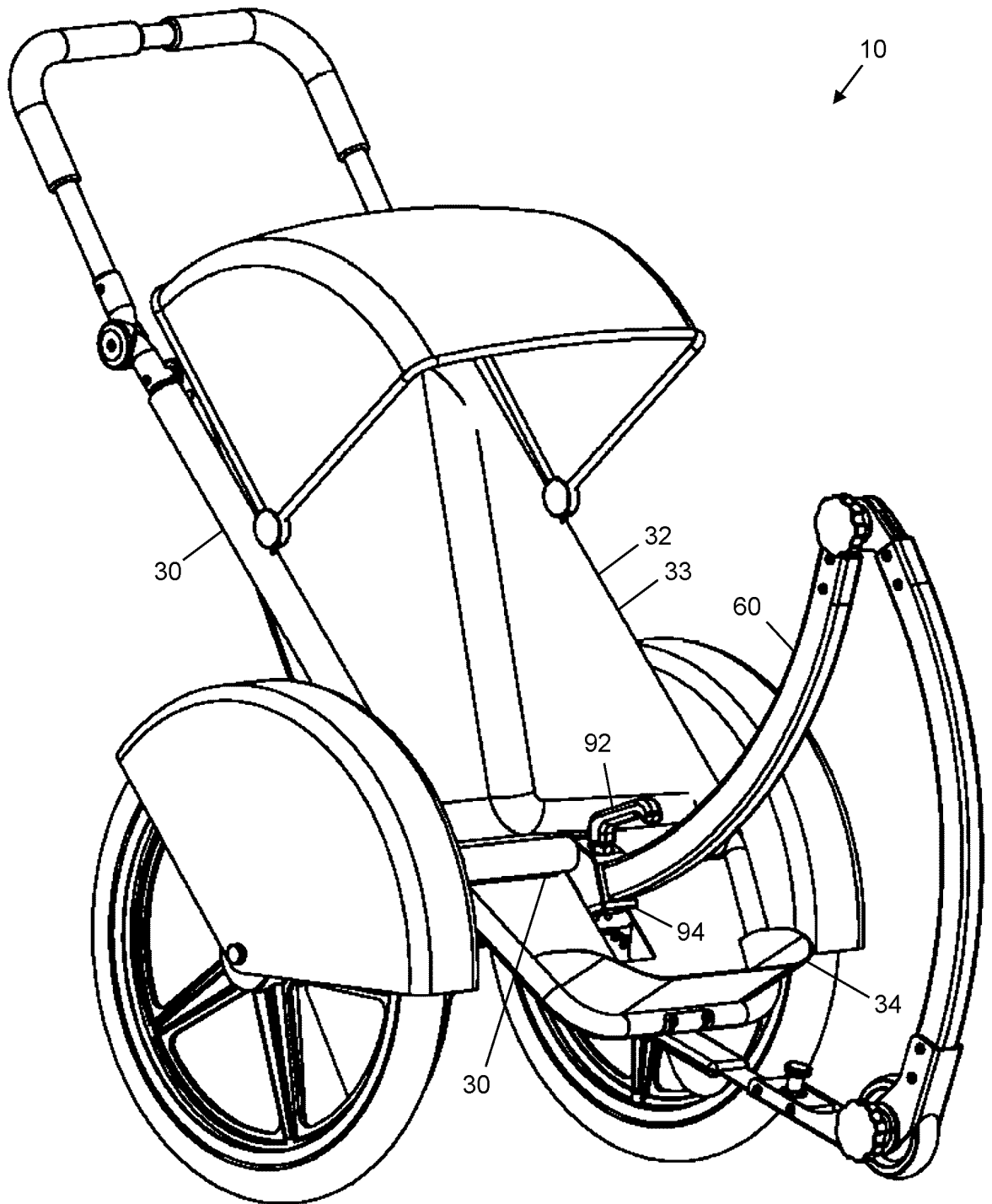
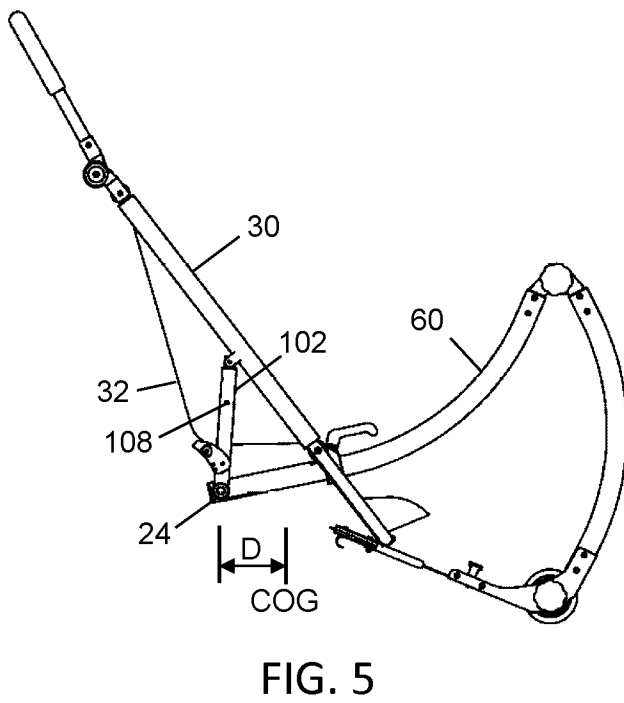
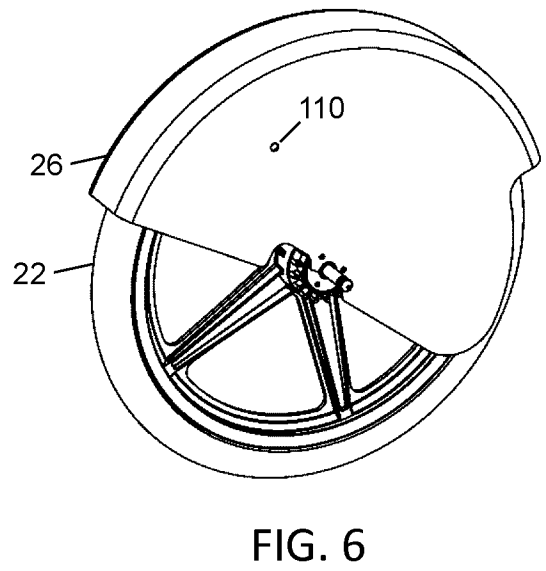
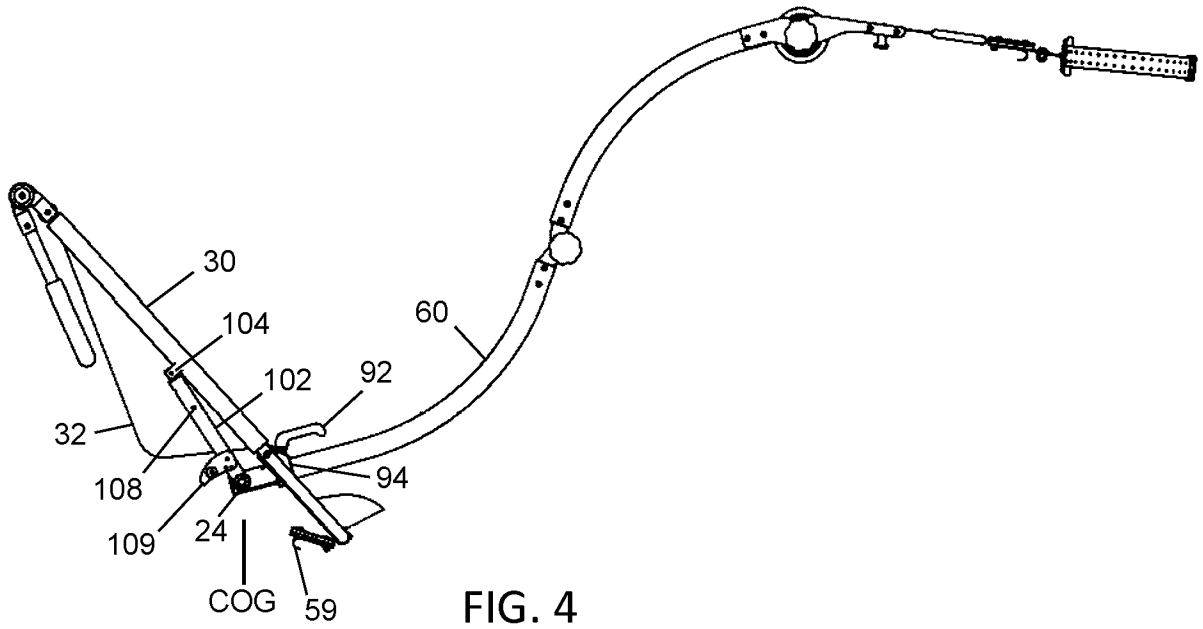
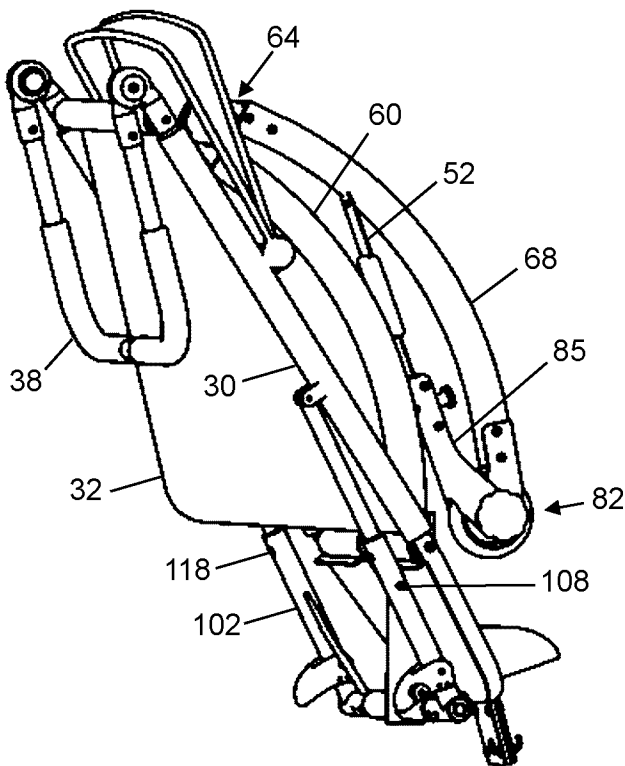
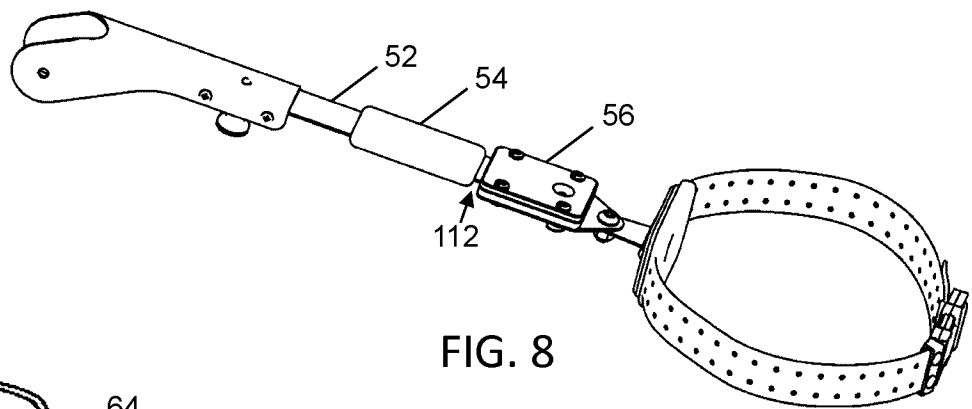
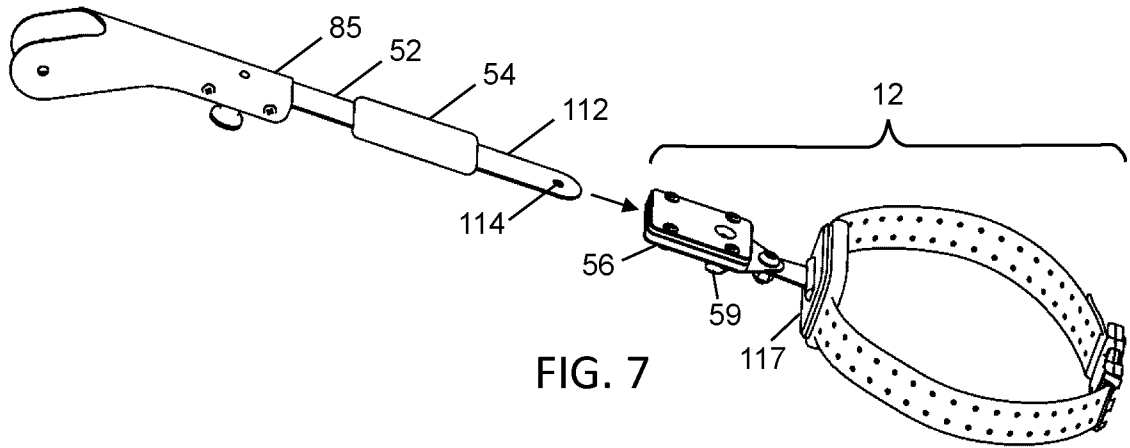


FIG. 3

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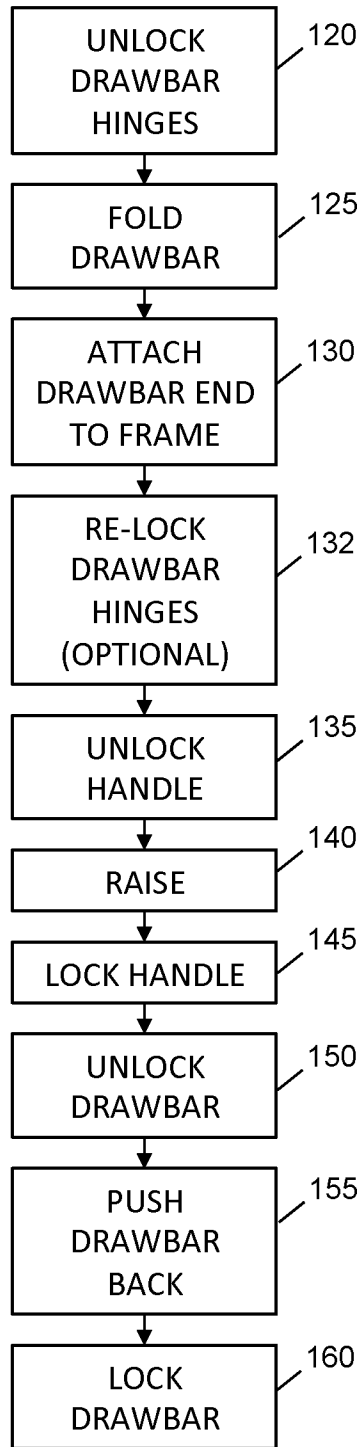


FIG. 10

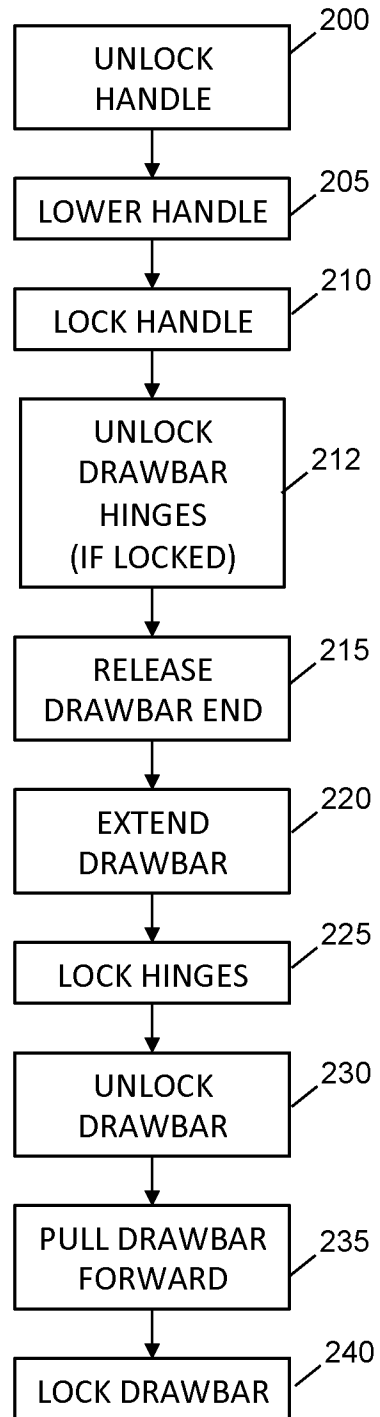


FIG. 11

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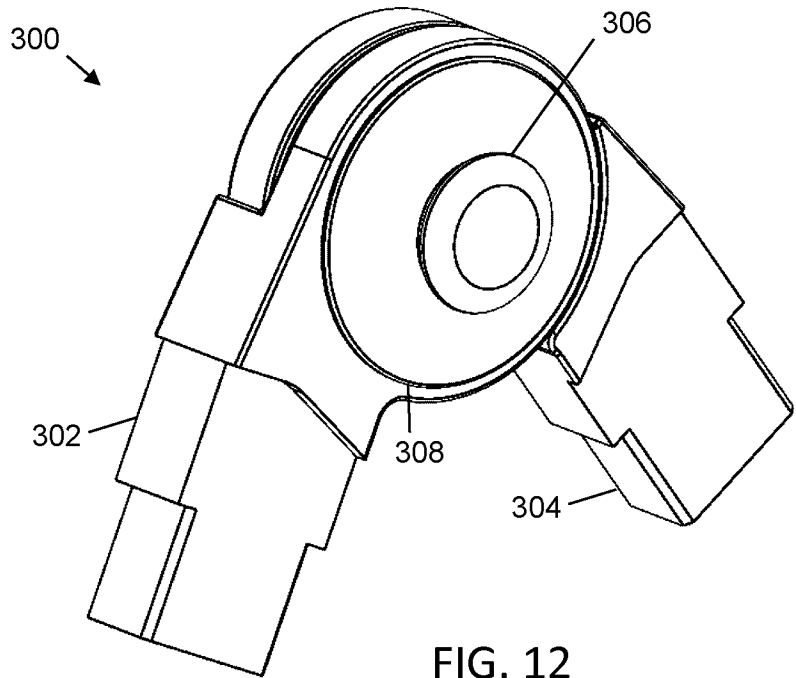


FIG. 12

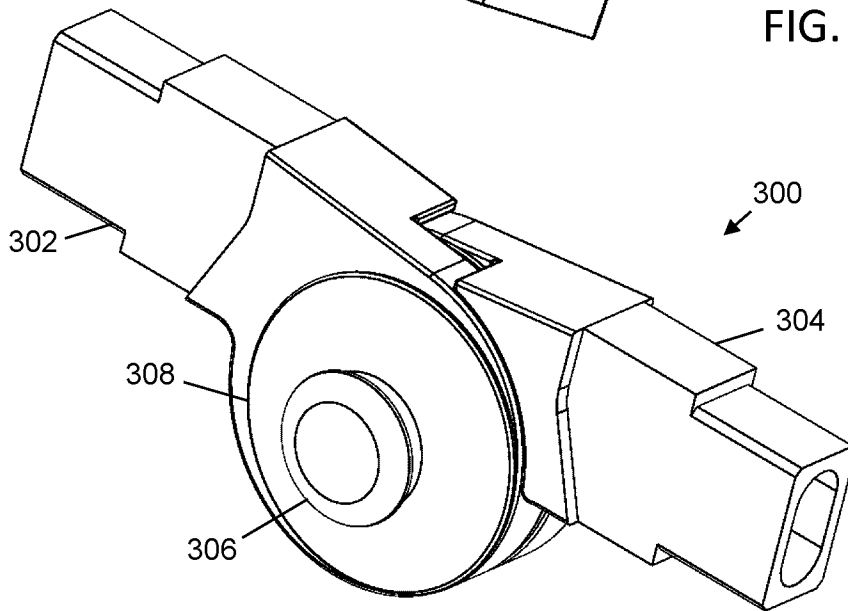


FIG. 13

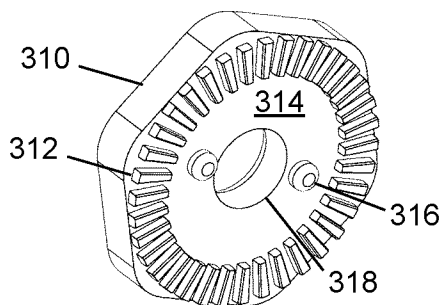


FIG. 14

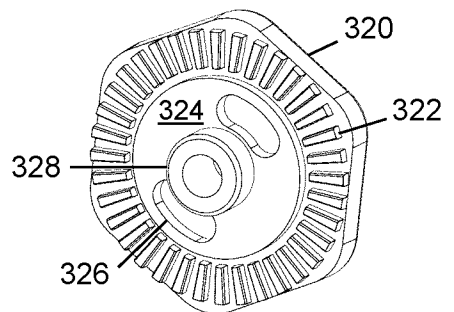


FIG. 15

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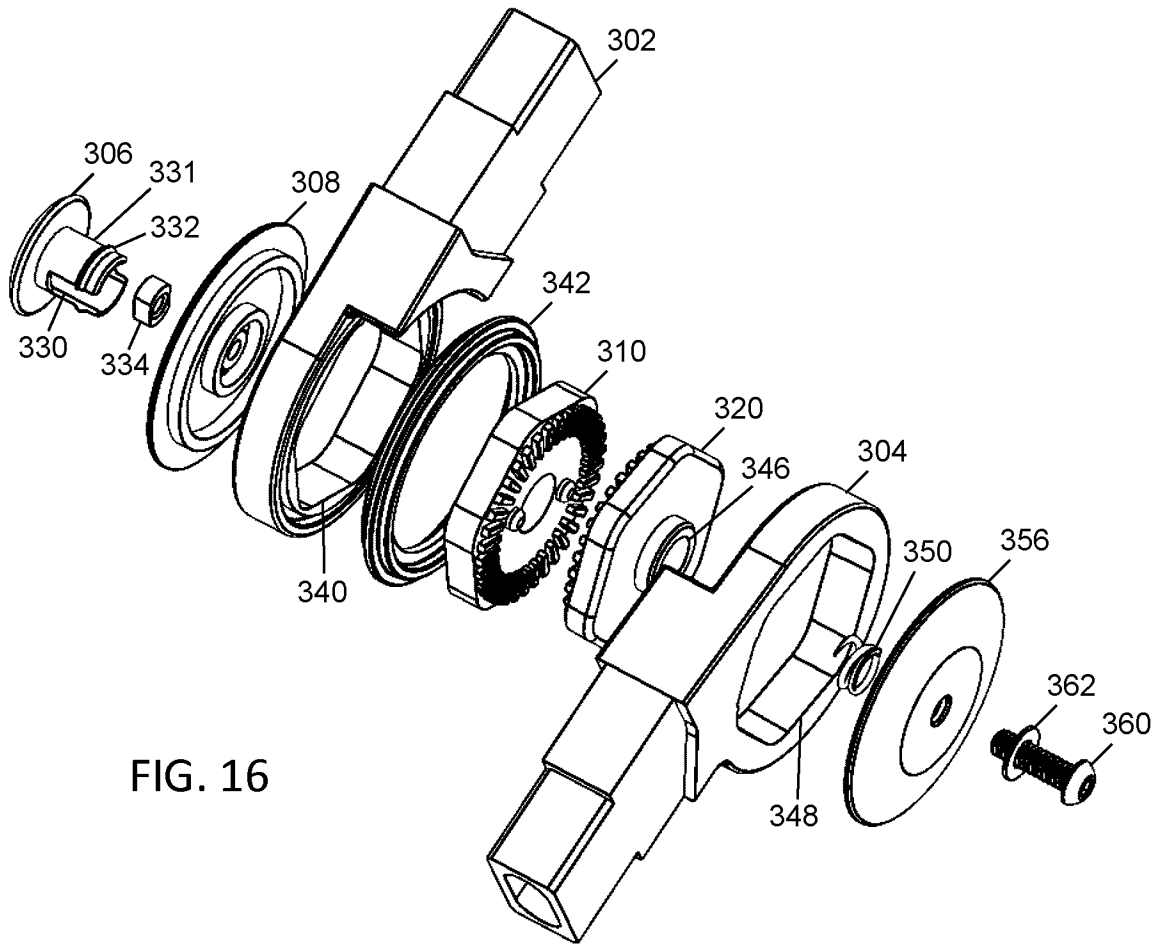


FIG. 16

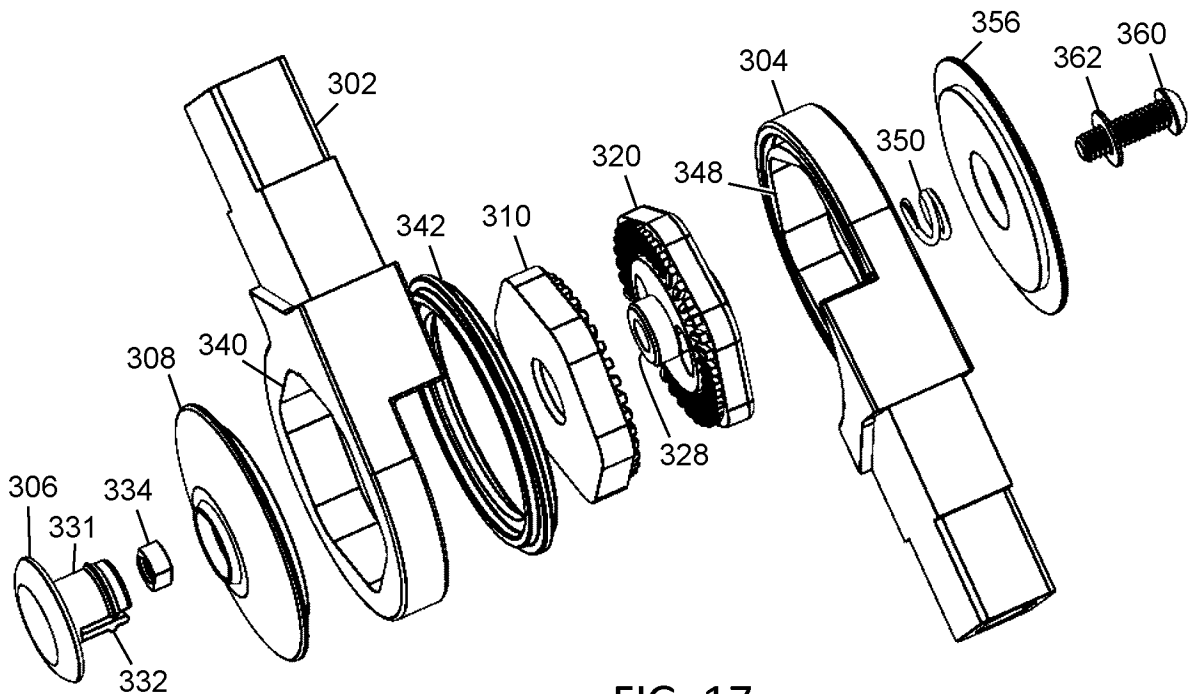


FIG. 17

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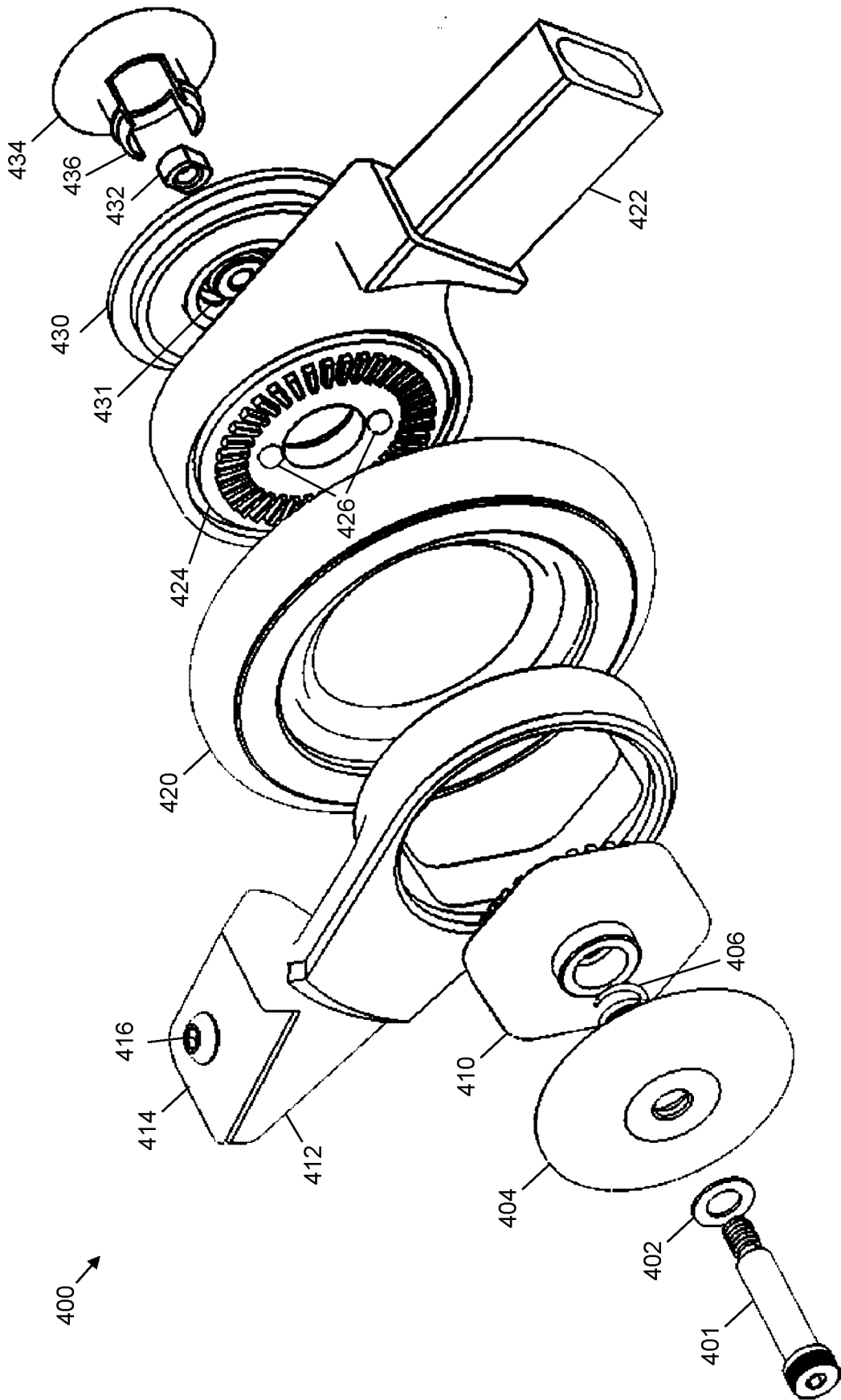


FIG. 18

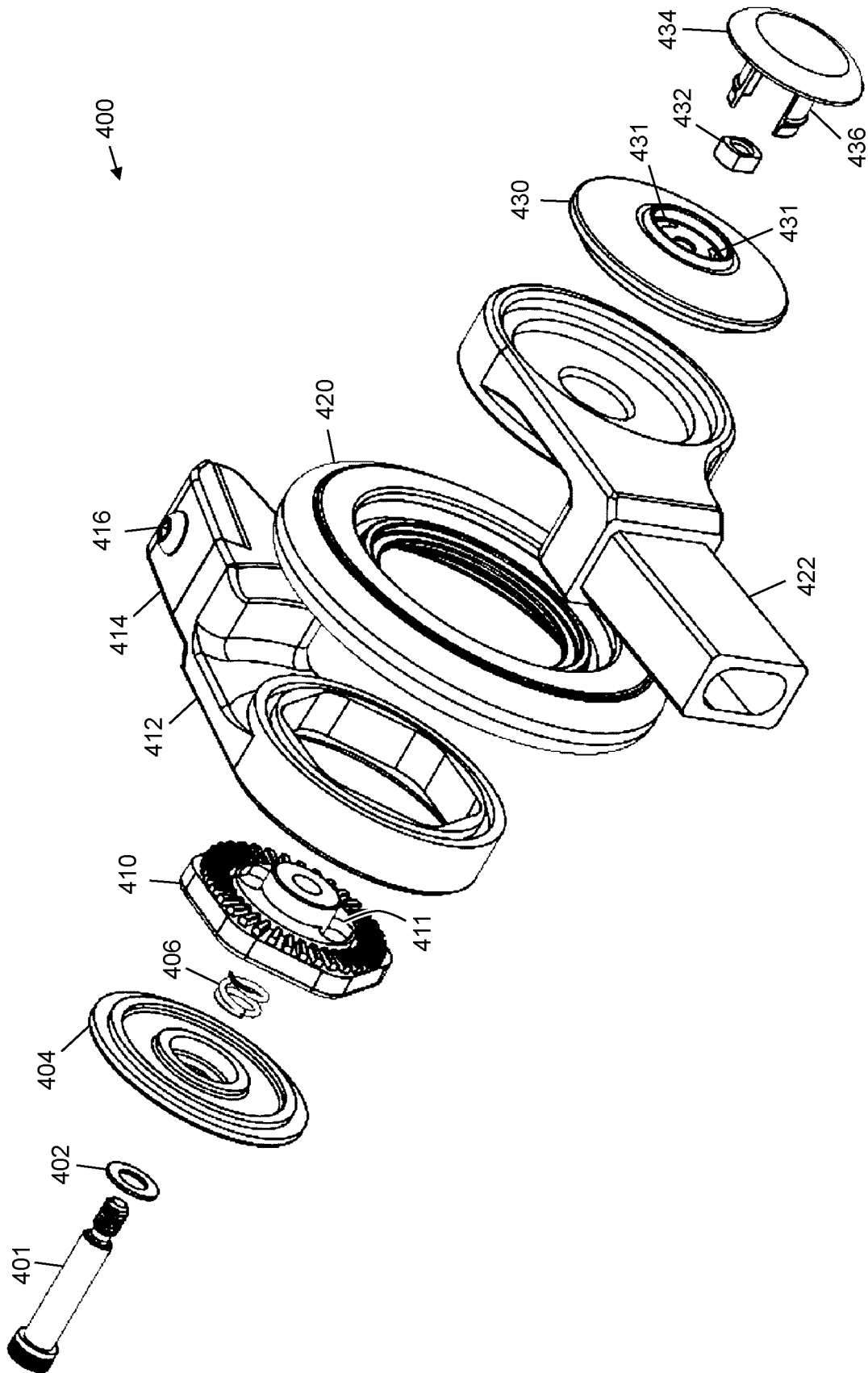


FIG. 19

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CA2018/050163

A. CLASSIFICATION OF SUBJECT MATTER
 IPC: **B62B 7/12** (2006.01), **B62B 7/06** (2006.01), **B62B 9/12** (2006.01), **B62B 9/20** (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 IPC: **B62B 7/12** (2006.01), **B62B 7/06** (2006.01), **B62B 9/12** (2006.01), **B62B 9/20** (2006.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)
 Questel, Google
 (STROLLER, CARRIAGE, PERAMBULATOR, DRAWBAR, BELT, HARNESS, PULL, WAIST, TOW, BAR, FOLDABLE)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB2413534A, (WALSH, C.) 02 November 2005 (02-11-2005) *see abstract and figures 2-5	1, 3, 4, 6
A	US1429966A, (OLSEN, H.) 26 September 1922 (26-09-1922) *see abstract and figures	1-15
A	US5106108A, (HOWELL, P.) 21 April 1992 (21-04-1992) *see abstract and figure 1	1-15
A	DE29804652U1, (ULRICH, A.) 14 May 1998 (14-05-1998) *see abstract and figure 1	1-15
A	US9840266B2, (CARADEC, A et al.) 12 December 2017 (12-12-2017) *see abstract and figures	1-15

Further documents are listed in the continuation of Box C.

See patent family annex.

* "A" "E" "L" "O" "P"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance earlier application or patent but published on or after the international filing date document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) document referring to an oral disclosure, use, exhibition or other means document published prior to the international filing date but later than the priority date claimed	"T" "X" "Y" "&"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art document member of the same patent family
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Date of the actual completion of the international search
 20 March 2018 (20-03-2018)

Date of mailing of the international search report
 16 April 2018 (16-04-2018)

Name and mailing address of the ISA/CA
 Canadian Intellectual Property Office
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 Gatineau, Quebec K1A 0C9
 Facsimile No.: 819-953-2476

Authorized officer
 Matthew Chisholm (819) 639-7839

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CA2018/050163

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO2017044984A1, (HANSON, C. et al.) 16 March 2017 (16-03-2017) *see abstract and figures	1-15
A	DE102010005650A1, (RIPPERGER, T. et al.) 28, July 2011 (28-07-2011) *see abstract and figures	1-15
A	DE102014012750A1, (SCHRADIN, M. et al.) 03 March 2016 (03-03-2016) *see abstract and figures	1-15
A	US7322584B1, (PARKER, G.) 29 January 2008 (29-01-2008) *see abstract and figures	1-15
A	FR2718407A1, (THIMONIER, R.) 13 October 1995 (13-10-1995) *see abstract and figures 2 and 3	1-15
A	DE20016536U1, (BLANKE, C.) 21 December 2000 (21-12-2000) *see abstract and figures	1-15

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CA2018/050163

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
GB2413534A	02 November 2005 (02-11-2005)	GB0409336D0 GB2413534A	02 June 2004 (02-06-2004) 02 November 2005 (02-11-2005)
US1429966A	26 September 1922 (26-09-1922)	None	
US5106108A	21 April 1992 (21-04-1992)	None	
DE29804652U1	14 May 1998 (14-05-1998)	None	
US9840266B2	12 December 2017 (12-12-2017)	US2016101800A1 US9840266B2	14 April 2016 (14-04-2016) 12 December 2017 (12-12-2017)
WO2017044984A1	16 March 2017 (16-03-2017)	WO2017044984A1 USD811950S	16 March 2017 (16-03-2017) 06 March 2018 (06-03-2018)
DE102010005650A1	28, July 2011 (28-07-2011)	None	
DE102014012750A1	03 March 2016 (03-03-2016)	None	
US7322584B1	29 January 2008 (29-01-2008)	US7322584B1 US7600764B1	29 January 2008 (29-01-2008) 13 October 2009 (13-10-2009)
FR2718407A1	13 October 1995 (13-10-1995)	FR2718407A1 FR2718407B1	13 October 1995 (13-10-1995) 28 June 1996 (28-06-1996)
DE20016536U1	21 December 2000 (21-12-2000)	None	