A folding assembly is provided as having a lever assembly cooperating with a fork member such that when the lever assembly moves, the fork member moves therewith. The folding assembly includes a spring member that biases a lever neck of the lever assembly away from the fork member. The folding assembly further includes a POD member, a POD cover, a latch member, and a spring member for biasing the latch in a desired direction. The folding assembly is supported by a base having a locking slot. A method is provided for collapsing or folding a scooter/skateboard from an upright position to a collapsed, folded position.
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REAR TRUCK AND FOLDING ASSEMBLY AND METHOD

Related Patent Applications

This application is a non-provisional patent application of provisional patent application, filed January 7, 2008, and having Serial No. 61/010,233. Benefit of the January 7, 2008 date is hereby claimed.

1. Field of the Invention

Embodiments of the present invention relate generally to folding assemblies. More specifically, embodiments of the present invention relate to a folding assembly for a scooter or skateboard, and to a method for collapsing or folding a scooter or skateboard from an upright position to a collapsed, folded position. Embodiments of the present invention further relate to a method for unfolding a skateboard from a folded (transport) position to an unfolded (riding) position.

Embodiments of the present invention relates to a lean steering truck assembly for riding devices such as scooters, skateboards, and roller skates and more particularly to a lean steering truck assembly including a structure for a floating king pin design to provide deep deck leaning capabilities during use. Embodiments of the present invention further relate to a method for producing deep deck leaning capabilities during use of a transportation vehicle.

2. Background of the Invention
A number of conventional scooters contain folding features that enable a scooter operator to collapse or fold a scooter from a riding position to a storing or transport position. Such folding features more particularly enable a scooter operator to pivot the handlebar stem of a scooter relative to a generally horizontal body (e.g., a platform assembly) associated with the handlebar stem. However, such folding features may not be manufactured in a cost effective manner, and do not provide easy release for the handlebar stem from an upright (operable) position to a collapsed, folded position.

Therefore, a scooter folding assembly is needed which may be cost effectively manufactured, while enabling a user to easily release the steering stem from an upright position to enable the scooter to be collapse to a compact size.

A compact lean steering truck assembly that provides deep deck lean capability. The lean steering truck assembly may be integrated into a four wheeled scooter. A pivotal coupling in the front hanger allows independent steering of the front and rear wheel assemblies. Front steering is controlled by the rider's hands twisting the handle bars to the right or left or straight ahead. Rear steering is controlled by the rider's feet and hands leaning the deck and handle bars relative to the plane of the ground. The ratio of deck lean to rear steering is a function of the hanger pivot axis angle but in general terms the deeper the deck lean the greater the rear wheel steering.
Skateboards utilize lean steering as the method of controlling the direction of travel such that leaning or banking the deck causes the wheels to steer. Typically, skateboards use two identical truck assemblies mounted inline, on the bottom surface and toward the ends of the skateboard deck with the mounting orientation of the trucks mirrored relative to each other.

Conventional lean steering of skateboards is such that leaning the deck to the right causes the front wheels (relative to the direction of travel) to steer to the right (toward the inside of the up-coming turn) while at the same time the rear wheels to steer to the left (toward the outside of the up-coming turn.) The reverse is also true in that leaning the deck to the left causes the front wheels to steer to the left while at the same time the rear wheels steer to the right. On a skateboard it does not matter which end of the board is pointing forward, leaning right results in a right turn and leaning left results in a left turn.

Conventional lean steering dynamics as described above is the same with scooters except that typically only one lean steering truck is used. In the case of a scooter utilizing a lean steering truck assembly mounted in the front leaning the scooter to the right will cause the front wheels to steer to the right and leaning the deck to the left will cause the front wheels to steer to the left. On the other hand, in the case of a scooter utilizing a lean steering truck assembly mounted in the rear then leaning the deck to the right will cause
the rear wheels to steer to the left and leaning the deck left will cause the rear wheels to steer to the right.

A conventional lean steering truck is composed of a truck base that mounts underneath the skateboard deck and a truck hanger with opposed axle members for carrying a pair of opposed wheels. These two primary elements are assembled with two pins, a king pin and a pivot pin. The king pin is typically a bolt that protrudes from the truck base that is tightly located within a bore in the truck base such that it remains aligned with the truck base. The pivot pin is typically a fixed feature of the truck hanger with a ball end that protrudes upwardly and is received and loosely supported by a cup shaped elastomeric bushing housed in the truck base.

Another feature of the truck hanger is a bore that the king pin passes through such that the truck hanger is able to wobble loosely about the king pin. Constraining the wobbly motion of the hanger relative to the truck base and king pin are one or two elastomeric bushings and washers mounted concentrically on the king pin and held in place by tension from a nut threaded onto one end of the king pin. The elastomeric bushings provide a return spring force that tends to locate the bore of the hanger in alignment with the king pin. Tightening the king pin nut squeezes the elastomeric bushings and increases the pressure on the bore of the truck hanger reducing the range of motion and increasing the force required to move the truck hanger relative to the truck base and king pin.
A general description of the function of a conventional lean steering truck follows. As the deck leans it rotates about a longitudinal axis, the base and king pin being fixed to the deck lean in unison with the deck. Being fixed to the truck base the king pin moves to the side with a pendulum motion. The truck hanger is constrained by contact of the two opposed wheels with the surface of the ground and by two virtual pivot points.

The first virtual point is the nominal center of the ball and socket connection between the pivot pin and the elastomeric pivot cup bushing of the base mounting bracket. The second virtual point lies upon the king pin axis at the nominal center of the bore of the truck hanger. A virtual axis of rotation is created that intersects both virtual pivot points. It is about this virtual axis, named by various sources as the "hanger pivot axis" or "steering axis" that the truck hanger rotates about when the deck is leaned. The location of both the virtual points and the resultant angle of the hanger pivot axis are defined by the geometry of any particular lean steering truck and how the truck is mounted relative to the deck. The angle of the hanger pivot axis in turn defines the lean steering ratio or how much steering will result from a given amount of deck lean.

Common to all conventional lean steering truck designs is the existence of a hanger pivot axis angle, typically ranging from 25 to 55 degrees relative to the longitudinal axis about which the truck hanger rotates. Also common to most conventional lean steering truck designs are some type of spring element for returning the deck to a central and neutral position. Various designs and materials are used to create
this return to center force that include elastomeric bushings or metal springs under compression while others use torsionally loaded springs or bushings.

Lean steering trucks as described above are designed for a limited range of leaning deck motion which is further reduced by the limited adjustment of the elastomeric bushings. In addition, typical applications have the lean steering trucks mounted to the bottom of a skateboard deck or to the bottom of a shoe as with skateboards and roller skates which places the bottom of the deck above the elevation of the wheels thereby raising the center of gravity and creating a high longitudinal roll axis of the deck. Such with the lean steering truck mounted to the bottom of a deck also limit the range of leaning motion of the deck due to interference and hazardous contact between the deck and the wheels upon leaning. Typical lean steering trucks for skateboards are designed as stand alone components that can be fitted to a variety of skateboard decks and are not easily integrated into the design of a metal framed scooter.

Summary of Embodiments of the Invention

Embodiments of the present invention provide a folding assembly having a lever assembly cooperating with a fork member such that when the lever assembly moves, the fork member moves therewith. A spring member biases a lever neck of the lever assembly away from the fork member. The folding assembly includes a POD member, a
POD cover, a latch member, and a spring member for biasing the latch in a desired direction. The folding assembly is supported by a base having a locking slot.

Embodiments of the present invention further provide a method for collapsing or folding a scooter/skateboard from an upright position to a collapsed, folded position. The method includes moving a lever in a desired direction to cause disengagement of a pin member from a pin seat and a latch slot. Continuing to move the lever causes the latch to move away from a POD cover and a portion of the lever to slide or move within a guide slot of the POD cover. A fork member of the scooter/skateboard moves with the lever. The lever is continually moved until being locked within a locking slot of a base.

Embodiments of the present invention provide a compact lean steering truck assembly that provides deep deck lean capability. One embodiment the invention is integrated into a four wheeled scooter utilizing the same ride dynamics as taught by US patent 6520517 which has a common assignee and is fully incorporated herein by reference as if repeated in verbatim immediately hereafter. Like the riding device of US patent 6520517, a pivotal coupling in the front hanger allows independent steering of the front and rear wheel assemblies. Front steering is controlled by the rider's hands twisting the handle bars to the right or left or straight ahead. Rear steering is controlled by the rider's feet and hands leaning the deck and handle bars relative to the plane of the ground. The precise ratio of deck lean to rear steering is a function of the hanger pivot axis angle but in general terms the deeper the deck lean the greater the rear wheel steering. The ride dynamics of US Patent No. 6520517 are such that the rider is free to
steer the front wheels to the right or left or straight forward independent of the deck lean dependent rear wheel steering.

An object of various embodiments of the invention is to provide integration of a lean steering truck assembly with a metal or tubular frame.

Another object of various embodiments of the invention is to provide a compact design with improved ground clearance so to reduce the possibility of hazardous contact of the king pin and king pin nut with ground irregularities or the transitions of a skate park, curbs, rails and the like.

A further object of various embodiments the invention is to provide greater range of leaning motion for the deck so as to better emulate the deep leaning, carving sensations associated with snowboarding and surfing.

Another further object of various embodiments the invention is to improve stability by lowering the center of gravity and lowering the longitudinal roll axis of the deck through the use of unique geometry and floating king pin design.

Another further object of various embodiments of the invention is to provide greater range of adjustment in preloading the elastomeric bushings.

These provisions, together with the various ancillary provisions and features which will become apparent to those skilled in the art as the following description proceeds, are attained by the methods and assemblies of the present invention.
Brief Description of the Drawings

Figure 1 shows a side elevational view of a scooter having the folding assembly of the present invention.

Figure 2 is a side elevational view of the scooter in a folded position.

Figure 3 is a partial, cut-away view of the folding assembly.

Figures 4-13 are various cut-away perspective views of the folding assembly.

Figure 14 is a segmented perspective view of the folding assembly.

Figure 15 is a segmented perspective view of the fork member and the release lever with dashed lines representing the coupling points of the fork member to the release lever.

Figure 16 is a segmented perspective view of the pin POD cover, the POD member, the latch spring, the latch, and the body member, folding assembly with the dashed lines representing the coupling points of the various members with each other.

Figure 17 is another cut-away perspective views of the folding assembly.

Fig. IA shows three riding views of a scooter with the front wheels steering straight ahead and all four wheels rolling straight forward. The center image shows the scooter not leaning, on the right the scooter is leaning to the right and on the left it is leaning to the left. Note that rear wheels are steering in the conventional manner for a lean steering truck assembly. When the deck is leaned to the right, the rear wheels steer to the left and visa versa. Also note that when the scooter is leaned and the rear wheels are steering, it is
still possible to roll straight forward in a yawed orientation by simply counter-steering with the front wheels to compensate for the rear wheel steering.

Fig. 2A shows three riding views of a scooter leaned to the right in progressively greater amounts. The arrows on the ground plane illustrate the direction of travel and the overall track width of the scooter in a turn. The image on the left shows a conventional right turn with the rear wheels steering left toward the outside of the turn and the front wheels steering right toward the inside of the turn. In this conventional right turn the rear wheels follow the arcing path of the front wheels in a relatively narrow track. The center image shows the rear wheels steering left and the front wheels counter-steering slightly with the scooter turning right in a yawed orientation. The image on the right shows the scooter at maximum lean with the rear wheels steering left and sliding toward the outside of the turn having lost partial traction with the ground. The right image shows the front wheels at maximum counter-steer, unaffected by deck lean, and steering into the direction of the sliding rear wheels thus maintaining an improved measure of control.

Figure 3A shows a front view, a right plane section view, and a close-up section view of embodiments of the invention, not leaned.

Figure 4A shows a perspective exploded view of embodiments of the invention with the Deck 2 removed for clarity.
Figure 5A shows views of embodiments of the invention leaned to the right and not leaned. The Deck 2 is removed and the Frame 1 is cutaway for clarity. Lines indicate orientation of the frame with the ground plane. The leaned image on the right illustrates the asymmetrical compression of the floating king pin bushing 15.

Figure 6A shows a ground level side view and a detailed frontal cross-section view of embodiments of the invention not leaned. The deck 2, truck hanger 9, floating king pin bushing 15, wheels 10 and other parts are removed from the cross-section for clarity.

Figure 7A shows and isolated front view and a front ground view of embodiments of the invention leaned to the right as indicated by angle 33. Note that the frame 1 and fixed king pin base 4 lean in unison being fixed together. The deck 2 and floating king pin bushing 15 are removed for clarity. Note the articulation and pendulum motion of the floating king pin 3 relative to the frame 1 and control arm 13 as indicated by angle 34 as well as the sideways arcing motion of control arm 13 relative to the frame 1. The side view also leaned to the right shows the resultant steering of the rear wheels relative to frame 1 as indicated by angle 35. The side view also shows the motion of floating king pin 3 within the elliptical bore of the control arm 25.

Figure 8A shows two detailed front section views from the ground level of the floating king pin assembly in isolation. The left image is of the assembly not leaned. In this image
note the normal alignment of all components. The right image shows frame 1 leaned to the right as indicated by the reference lines and the angle formed between the frame 1 and the ground. The floating king pin 3 passes concentrically through floating king pin washer 16 such that the radiused lower surface of the floating king pin head 22 is supported on the top inside edge 11 of the floating king pin washer 16 acting as a hemispheric ball joint. The floating king pin then passes through elliptical bore in the frame 17 so shaped as to allow pendulum, pivoting and waffling motion of the floating king pin 3, through floating king pin bushing bore 23 removed here but as shown in Figure 4, through elliptical bore in the control arm 25 also so shaped so as to allow pendulum, pivoting and wobbling motion of the floating king pin 3, and is secured by floating king pin nut 14 which is shown in tangent contact with the radiused lower surface 32 of control arm 13. The radiused lower surface 32 of the control arm 13 is so shaped to facilitate the pendulum, pivoting and wobbling motion of the floating king pin 3 while also being adjustable by threading in and out to set the initial loading of the elastomeric floating king pin bushing 15. Floating king pin nut 14 utilizes typical thread lock design to maintain secure fastening and not become loose in use.

Figure 9A shows top views of the invention not leaned and leaned to the right. Deck 2 is removed and frame 1 is partially cut away for clarity. This figure highlights the steering action of the truck hanger 9 as indicated by angle 37 upon sideways motion of the control arm 13 as well as the motion of truck hanger 9 relative to the other components. Note that the fixed king pin 8 rotates about its own axis in unison with leaning of the deck. Also
note the asymmetrical compression of both fixed king pin elastomeric bushings 5 and 6 in front of and partially inside of truck hanger 9.

Common reference numerals are used throughout the drawings and detailed description to indicate like elements.

**Detailed Description of the Embodiments of the Invention**

In the description herein, numerous specific details are provided, such as examples of components and/or methods, to provide a thorough understanding of the embodiments of the present invention. One skilled in the relevant art will recognize, however, that an embodiment of the invention may be practiced without one or more of the specific details, or with other apparatus, systems, assemblies, methods, components, materials, parts, and/or the like. In other instances, well-known structures, materials, or operations are not specifically shown or described in detail to avoid obscuring aspects of the embodiments of the present invention.

Referring in detail now to the drawings, there is seen a scooter 8 having front assembly, a folding assembly 18 and a rear assembly 14. While the folding assembly 18 will be described by referencing various parts of a scooter, it is to be understood that the folding assembly 18 may be adapted for or employed with any suitable assembly would fold from an upright position to a collapsed position.
The folding assembly 18 is supported by part (e.g., an end) of a support body 100 which includes a locking slot 22. The folding assembly 18 comprises a fork member 104 having a front slot 56. The fork member 104 at one end is bound to a head tube 108 which defines a sleeve through which a strut 12 passes. A pair of fork members 106-106 is formed at the other end of the fork member 104. The fork members 106-106 pivot about pin 110 which passes through one fork member 106, through an opening in a POD cover, through an opening in a POD structure, through the support (base) body 100, and then through another opening [or aperture] in the POD structure, through another opening in the POD structure, and through an opening in the other fork member 106 such that the fork member 104 [including fork members 106-106] ss to be able to pivot about pin 110. Slidably passing through the front slot 56 is a neck 30 of a release lever 26. An end of the lever 26 includes a lever neck recess 34 which releasably lodges in the locking slot 22 of the support body 100 when the scooter 8 is in a folded position as illustrated in Fig. 9.

A release lever spring 62 continually biases the neck of the handle away from any suitable structure, such as the underside of fork member 104. As best shown in Fig. 4, the release lever spring 62 includes a U-shaped spring section 64 and a pair of spring arms 68-68. The U-shaped spring section 64 lodges over an edge of the neck 30 as best shown in Figs. 6 and 7 while the spring arms 68-68 are in bias contact with the underside of the fork member 104.

When the handle 26 is moved in direction of the arrow A in Fig. 5, the spring 62 commences to collapse to a further coiled position, increasing the urging pressure or bias contact of the spring section 64 against the edge of the neck 30, and the spring arms 68-
68 against the underside surface of the fork member 104. The release lever spring 62 may have any suitable configuration, such as the embodiment of the release lever spring 62 is that shown in Fig. 15.

The folding assembly 18 also comprises a latch 72, a POD cover 130, a POD member 150, and a latch spring 85.

The latch 72 has a latch slot 84-84 which respectively terminates in latch lugs 87-87, which in an embodiment of the invention, may removably extend through openings 49-49 in the POD cover 130. When the latch 72 moves up and down, the latch lugs 87-87 respectively move in and outer of the openings 49. The latch 72 also includes latch ramps 80-80, a latch floor 77 against which a lower edge of the neck 30 movably moves along and/or urges downwardly [in direction or arrow B] as illustrated in Fig. 11. As lever 26 begins to move in direction of arrow A in Figs. 6 and 11, the lower edge of the neck 30 commences to movably contact and move the floor 77 of the latch 72 in direction of arrow B. A pin 32, which is connected to neck 30, is unseated from the slot 84 and begins to contact and travel down the ramps 80-80. The pin 32 is also coupled with the fork member 104 [i.e., openings 99-99, only one shown in Fig. 15] such that as lever 26 is moving in a desired direction, the fork member 104 simultaneously moves therewith. Thus, the pin 32 passes through one of the openings 99, through opening 35 in the neck 30 and then through the other opening 99 [see Fig. 15], such that lever 26 and fork member 104 move in unison.
In an embodiment, the pin 32 may also assists in moving the latch 72 in direction of arrow B. As the latch 72 begins to move downwardly, a latch spring 85 commences to coil to place it into a more taut posture. A U-shaped section 89 is in contact with the underside or latch bottom 76 of the latch floor 77 such that as the latch 72 moves downwardly, the U-shaped section of the spring 85 moves downwardly to start coiling the spring 85. The pair of spring arms 91-91 is in contact with a rear wall 153 of the POD member 150 to prevent the arms 91-91 from moving and allows the spring 85 to begin coiling.

In an embodiment of the invention, when lever 26 is to be moved to position the folding assembly 18 such that the scooter is an unfolded position, the lever 26 travels and operates in a reverse procedure. More specifically, as the fork member 104 (including the lever 26) is moved toward the upright position after latch recess 34 has been dislodged from locking slot 22, the lower edge of the neck 30 contacts the floor 77 of the latch 72 and commences to move the latch 72 in a direction opposite arrow B and the pin 32 begins to travel along and upwardly along the latch ramps 80-80.

The POD cover 150 has a guide slot 50, in addition of openings 49-49. The lower part of the neck 30 slidably moves up and down within the guide slot 50 as the folding assembly 18 respectively folds and unfolds the scooter [see Figs 5 and 8]. A front end structure 58 of the fork member 104 moves [slidably] up and down and along a guide ramp 46 of the POD cover 150 as the fork member 104 moves back and forth.

As indicated the POD member 150 has a rear wall 153. The POD member 130 also has a pair of opposed POD openings 161-161. The latch 72 has a pair of latch
openings 167-167. The latch 72 and latch spring 85 pivotally operate within the sides of the POD member 150. A pin 201 passes through one POD member opening 161, through one of the latch openings 167, through the cylindrical coiled part of the latch spring 85, through the other latch opening 167 and then through the second latch opening 167. Pin 201 is the pivot point on which latch 72 pivots.

The POD member 150 further includes POD member apertures 211-211 and 213-213. POD cover 130 comprises openings 239-239 and 241-241. The POD member 150 is situated within the walls of the POD cover 130. The POD member 150 and the POD cover 130 are supported by and are coupled to body 100 by: (i) passing pin 249 through one of the POD cover openings 241, through one of the POD apertures 211, through one of the body openings 281, and then through the other body opening 281, through the other POD aperture 211, and through the other POD cover opening 241; and (ii) passing pin 251 through one of the POD cover openings 239, through one of the POD apertures 213, through one of the body openings 283, and then through the other body opening 281, through the other POD member aperture 211, and subsequently through the other POD cover opening 241 [see Fig. 16].

As previously indicated, the folding assembly 18 has two positions: the unfolded position illustrated in Fig. 1 and the folded position illustrated in Fig. 2.

For various embodiments of the invention, when the folding assembly 18 is in an unfolded position, the skateboard/scooter is in an operative position, a position for use. In the unfolded position, and in an embodiment of the invention, is seated in latch slot 84
of latch 72. Contacting the latch bottom 76 is a latch spring 85. The upper section of the neck 30 of release lever 26 is slidable within slot 56 of the front structure 54 [i.e., the front section of the fork member 104], and the lower section of the neck 30 is formed with neck recess 34 and is slidable within guide slot 50 of the guide ramp 46 (the POD cover 130). As shown in Fig. 4, the release lever spring 62 is coiled such that when compressed, U-shaped spring section 64 is being urged away from spring arms 68-68. Neck 30 is positioned within and passes through the U-shaped opening of the U-shaped spring section 64. The spring arms 68-68 contact and extend along the bottom of the front structure 54. When spring 62 is in a compressed position, neck 30 is being biased by release lever spring 62 downwardly away from the bottom of the front structure 54.

When the folding assembly 18 is in the folded position, the skateboard/scooter is in a position for being transported. As best shown in Fig. 7, the end of the lower section of the neck 30 is situated within the locking slot 22 of the rear structure. Part of the edge that forms the boundary of the locking slot 22 is disposed within neck recess 34 for locking the release lever 26 is the position illustrated in Fig. 7. When the lever 26 is in this position, the spring 62 is in a compressed state where U-shaped spring section 64 is being urged away from the pair of spring arms 68-68.

To change the folding assembly 18 from its unfolded position (skateboard/scooter riding position) into its folded position [skateboard/scooter transport position], the head of the release lever 26 is grasped and pulled downwardly in direction of the arrow A. This causes the upper section of the lever neck 30 to start moving downwardly within the
front slot 56, and causes the lower section of the lever neck 30 to start moving downwardly within the guide slot 50 of the guide ramp 46 of the POD cover 130. As release lever 26 commences to move downwardly, pin 32 begins to unseat from within latch slot 84, and lever spring 62 starts compressing.

With further downward movement of the lever 26: (i) pin 32 is unseated from within latch slot 84, (ii) pin 32 starts traveling down the latch ramp 80, (iii) latch spring 85 starts compressing, and (iv) latch 72 starts moving downwardly, away from guide ramp 46.

With continuing downward movement of the lever 26, pin 32 is released from/off the latch ramp 80, latch 72 is moved up by the latch spring 85, and the guide slot 50 guides the lower section of the neck 30 into the slot 22 where part of the edge that forms the boundary of the locking slot 22 is disposed within neck recess 34 for locking the release lever 26. As previously indicated movement of the lever 26 causes the fork member 104 to move therewith.

To change folding assembly 18 from its folded position [skateboard/scooter transport position] into its unfolded position (skateboard/scooter riding position), the procedure is reversed from the prior procedure. Broadly describing the procedure:

Part of the edge that forms the boundary of the locking slot 22 is removed from within neck recess 34 of lever neck 30. Lever 26 is moved forward (i.e., towards latch
causing the lever spring 62 to start decompressing. Pin 32 contacts the end of the latch ramp 80 and moves the latch 72 downwardly toward the rear structure 16, causing the latch spring 85 to begin compressing. In an embodiment of the invention, the lower part of the neck 30 assists in moving the latch 72 downwardly by slidably contacting the floor 77 of the latch 72 as the lever moves. The pin 32 continually travels up the latch ramp 80 until slipping into latch slot 84.

While the lean steering (tuck) assembly will be described by referencing various parts of a truck, it is to be understood that the lean steering assembly may be adapted for or employed with any suitable transportation device that is to lean when desired. For purposes of various embodiments of the invention, the lean steering assembly will be employed with a truck and will be designated or called lean steering truck assembly.

Referring now to Figures 1A-9A, embodiments of the invention are a lean steering truck assembly that utilizes a floating king pin design which moves from side to side in a pendulum motion as well as pivots and wobbles, thus offering a broader range of leaning motion than is currently available with typical king pin and bushing based lean steering trucks, commonly known as skateboard trucks.

The Deck 2 is securely mounted to the Frame 1 such that both components move in unison. The Frame 1 is a tubular member supporting the rider and spanning the front and rear wheel assemblies. The Frame 1 is, on the forward end, mounted to a folding mechanism, a neck, and a headtube and shall be described collectively as frame elements. A handle bar and riser assembly are connected to a steer tube and fork and shall be
described collectively as the steering column. A headset bearing assembly is mounted to the top and bottom of the headtube and rotatably connects the steering column to the frame elements such that the steering column and frame elements are each able to freely rotate about a common longitudinal axis relative to the other. The front hanger is pivotally mounted to a fork on an axis that is normal to the common longitudinal. As with US patent 65205 17, the front wheels to maintain uniform contact with the ground during normal riding conditions and can be steered via the handle bars independent of leaning of the frame elements and rear wheel steering.

The head of floating king pin 3 has a radius lower surface 22 that acts as a hemispheric bearing surface with the top inside edge 11 of floating king pin washer 16. Floating king pin washer 16 sits flush on the top surface of frame 1 over elliptical bore 17. The floating king pin 3 is mounted through the center of washer 16 and through elliptical bore 17 such that the head of the floating king pin 3 is unable to pass through either washer 16 or elliptical bore 17 wherein body of floating king pin 3 remains free to move in a pendulum manner as well as pivot and wobble. Floating king pin bushing 15 is elastomeric and mounted such that bore 23 is concentric with the floating king pin 3 and such that the top surface of floating king pin bushing 15 is flush with the inner surface of the top of frame 1 while the bottom surface is flush with the top of truck hanger control arm 13. The threaded end of floating king pin 3 passes through elliptical bore 25 of control arm 13 and is fastened on the radiused bottom side of control arm 13 by floating king pin nut 14 such that the floating king pin 3 is still able to move in a pendulum manner as well as pivot and wobble. The end of the truck hanger control arm 13 at the
elliptical bore 25 is in turn constrained by contact with the bottom surfaces of floating king pin bushing 15 and by contact with the top surface of the floating king pin nut 14 such that control arm 13 moves with the pendulum and wobbling motion of floating king pin 3.

The rear wheel assemblies 10 contain ball bearings and are oppositely mounted to axle 12 on either side of truck hanger 9. In the current embodiment, truck hanger 9 and control arm 13 are fixed together by welding or other means, function as a single unit, and move in unison. Alternative embodiments are imagined with a singular casting or fabrication that combines elements while maintaining the same function.

The fixed king pin base 4 is securely attached to frame 1 by welding or other means. Fixed king pin 8 is press fit or otherwise mounted into bore 19 such that a length of fixed king pin 8 protrudes rearward from the rear surface of the fixed king pin base 4 such that the fixed king pin 8 only moves in unison with frame 1. A forward fixed king pin bushing 5 is mounted concentric with the fixed king pin 8, flush on the front side with the rear surface of the fixed king pin base 4, and flush on the rear side with the front surface of the truck hanger 9. The fixed king pin passes through an oversized bore 20 in the truck hanger 9. The rear fixed king pin bushing 6 is mounted concentric with the fixed king pin 8 flush with a rear surface of truck hanger 9. Fixed king pin washer 26 and fixed king pin nut 7 are threaded onto the end of fixed king pin 8. The range of motion of the invention within the constraints of a given overall geometry is controlled by the durometer and
shape of the elastomeric king pin bushings, the fit between the elastomeric bushings and all contact surfaces, and the tightness of both the fixed and floating king pin nuts.

At rest the scooter remains vertical with all four wheels on the ground. In this the not leaned condition where the top surface of frame 1 would be nominally parallel with the ground and the floating king pin axis would be nominally normal with the ground. At rest all elastomeric bushings are uniformly loaded with only a minimum compression present from the assembly tightness of the king pin nuts. Differential down force on frame 1 causes asymmetrical compression of the floating king pin bushing 15 which causes floating king pin 3 to begin its pendulum motion sideways. When the frame elements lean, the fixed king pin 8 rotates about its axis within elastomeric fixed king pin bushings 5 and 6 and within oversized bores 20 and 21 of the truck hanger 9. The truck hanger 9 and control arm 13 are constrained by a return force from the ground and wheels 10 and as well as by fixed king pin bushings 5 and 6. So constrained, the pendulum and wobble motion of floating king pin 3 forces truck hanger 9 to move in a sideways arc relative to the frame elements which results in steering of the rear wheels.

Geometry of the invention is adjusted to optimize the balance of front and rear steering and for safety so that the deck and frame never contact wheels when riding.

Reference throughout this specification to "one embodiment", "an embodiment", or "a specific embodiment" means that a particular feature, structure, or characteristic
described in connection with the embodiment is included in at least one embodiment of the present invention and not necessarily in all its embodiments. Therefore, the respective appearances of the phrases "in one embodiment", "in an embodiment", or "in a specific embodiment" in various places throughout this specification are not necessarily referring to the same embodiment. Furthermore, the particular features, structures, or characteristics of any specific embodiment of the present invention may be combined in any suitable manner with one or more other embodiments. It is to be understood that other variations and modifications of the embodiments of the present invention described and illustrated herein are possible in light of the teachings herein and are to be considered as part of the spirit and scope of the present invention.

Additionally, any arrows in the drawings/figures should be considered only as exemplary, and not limiting, unless otherwise specifically noted. Furthermore, the term "or" as used herein is generally intended to mean "and/or" unless otherwise indicated. Combinations of components or steps will also be considered as being noted, where terminology is foreseen as rendering the ability to separate or combine is unclear.

As used in the description herein and throughout the claims that follow, "a", "an", and "the" includes plural references unless the context clearly dictates otherwise. Also, as used in the description herein and throughout the claims that follow, the meaning of "in" includes "in" and "on" unless the context clearly dictates otherwise.
The foregoing description of illustrated embodiments of the present invention, including what is described in the Abstract, is not intended to be exhaustive or to limit the invention to the precise forms disclosed herein. While specific embodiments of, and examples for, the invention are described herein for illustrative purposes only, various equivalent modifications are possible within the spirit and scope of the present invention, as those skilled in the relevant art will recognize and appreciate. As indicated, these modifications may be made to the present invention in light of the foregoing description of the illustrated embodiments of the present invention and are to be included within the spirit and scope of the present invention.

Therefore, while the present invention has been described herein with reference to the particular embodiments thereof, a latitude of modification, various changes and substitutions are intended in the foregoing disclosures, and it will be appreciated that in some instances some features of the embodiments of the invention will be employed without the corresponding use of other features without departing from the scope and spirit of the invention as set forth. Therefore, many modifications may be made to adapt a particular situation or material to the essential scope and spirit of the present invention. It is intended that the invention not be limited to the particular terms used in following claims and/or to the particular embodiment disclosed as the best mode contemplated for carrying out this invention, but that the invention will include any and all embodiments and equivalents falling within the scope of the appended claims.
WHAT IS CLAIMED IS:

1. A folding assembly comprising a fork member having a structure defining a fork slot; a handle slidably disposed within the folk slot and within a guide slot of a POD cover member; a spring member for biasing the handle member away from the fork member; a latch member pivotally connected to a pin supported by a POD member; a pin member coupled to the lever and to the fork member such that the fork member moves when the lever moves; a POD cover member disposed over the POD member; and the POD member and the POD cover member are coupled to a base have a locking slot which locks the lever in place; and a latch spring engaged to the latch member and to a wall of the POD member.

2. A method for collapsing or folding a scooter/ skateboard from an upright position to a collapsed, folded position comprising: moving a lever in a desired direction to cause a fork member to move and disengagement a pin member from a latch slot of a latch member; continuing to move the lever to cause the latch to move away from a POD cover and to further cause a portion of the lever to slide or move within a guide slot of the POD cover; and locking the lever into a locking slot in a base.

3. A lean steering truck assembly for riding devices comprising a support structure, a king pin supported by the support structure, said floating king pin design provides a deep deck leaning capabilities during use.
4. A method for producing deep deck leaning capabilities during use of a transportation vehicle comprising leaning the vehicle in a desired direction by turning a steering assembly which is adapted to provide a desired articulation.
INTERNATIONAL SEARCH REPORT

International application No
PCT/US 09/00055

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A63C 1/00, 17/00 (2009.01)
USPC - 280/11.27
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)
USPC: 280/11.27

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC 280/1 27; 11.28, 87.041, 87 042
See Search Terms Below

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
pubWEST/PGPB,USPT,EPAB,JPAB), USPTO; Google Web
Search Terms Used, skateboard, scooter, fold$, collapse$, handle, kingpin, deck lean, articulating$, lean$, movement, board, deck,
front truck, steer$, structure, support, member, POD

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No</th>
</tr>
</thead>
</table>

D. Further documents are listed in the continuation of Box C

* Special categories of cited documents
'A' document defining the general state of the art which is not considered to be of particular relevance
'E' earlier application or patent but published on or after the international filing date
'L' 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)
'O' document referring to an oral disclosure, use, exhibition or other means
'P' document published prior to the international filing date but later than the priority date claimed
'T' 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

Date of the actual completion of the international search
20 June 2009 (20.06.2009)

Date of mailing of the international search report
30 JUN 2009

Name and mailing address of the ISA/US
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Lee W. Young
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PCT OIF: 571-272-7774

Form PCT/ISA/2 10 (second sheet) (April 2007)
### INTERNATIONAL SEARCH REPORT

#### Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. **Claims Nos:**
   - Because they relate to subject matter not required to be searched by this Authority, namely:

2. **Claims Nos:**
   - Because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. **Claims Nos:**
   - Because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6 4(a)

#### Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

- **Group I:** claims 1 and 2
- **Group II:** claims 3 and 4

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1. **As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims**

2. **As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees**

3. **As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos**

4. **No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims, it is covered by claims Nos 1 and 2**

#### Remark on Protest

- **The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee**
- **The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation**
- **No protest accompanied the payment of additional search fees**

Form PCT/ISA/210 (continuation of first sheet (2)) (Apr 2007)
Box No III Observations where unity of invention is lacking (Continuation)

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 131:

Group I. claims 1 and 2, drawn to a folding assembly comprising
a fork member having a structure defining a fork slot,
a handle slidably disposed within the fork slot and within a guide slot of a POD cover member,
a spring member for biasing the handle member away from the fork member, a latch member pivotally connected to a pin supported by a POD member, a pin member coupled to the lever and to the fork member such that the fork member moves when the lever moves, a POD cover member disposed over the POD member, and the POD member and the POD cover member are coupled to a base having a locking slot which locks the lever in place, and
a latch spring engaged to the latch member and to a wall of the POD member.

Group II, claims 3 and 4, drawn to a lean steering truck assembly for loading devices comprising a support structure, a king pin supported by the support structure, said floating king pin design provides a deep deck leaning capabilities during use.

The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 131 because, under PCT Rule 132, they lack the same or corresponding special technical features for the following reasons:

Group I does not include the inventive concept of a lean steering truck assembly for loading devices comprising a support structure and a king pin, as required by Group II.

Group II does not include the inventive concept of a fork member, a handle slidably disposed within the folk slot, a spring member for biasing the handle member away from the fork member, a latch member connected to a pin supported by a POD member, a pin member coupled to the lever and to the fork member, a POD cover member, and the POD member and cover member coupled to a base, and
a latch spring engaged to the latch member and to a wall of the POD member, as required by Group I.

None of these technical features are common to the other groups, nor do they correspond to a special technical feature in the other groups. Therefore, unity of invention is lacking.