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(56) Documents Cited:
US 6367828 B1 **US 6182985 B1**
US 20130001909 A1 **US 20100072722 A1**
US 20090273152 A1 **US 20050140108 A1**
WO 02096527

(58) Field of Search:
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Other: **WPI, EPODOC**

(54) Title of the Invention: **Riding device**
Abstract Title: **Scooter with a skateboard for a base**

(57) A riding device comprises a deck 5 for supporting a rider, a steering portion 2 pivotably mounted to the deck which rotates with respect to the deck about a generally horizontal and longitudinal axis. A steering handle 1 extending from the steering portion pivots the steering portion about the generally horizontal and longitudinal axis. A front truck 4 is attached to the steering portion so that it is pivoted about the generally horizontal and longitudinal axis and a rear truck 6 attached to the deck so as to cause a steering effect when the deck is tilted about the generally horizontal and longitudinal axis by a change in weight distribution by a rider. A riding device comprising skis, skates or metal runners is also claimed. The board may be electrically powered. The steering handle may be folded and locked in a plurality of riding positions. Stops may be provided to limit the rotation of the deck. The board may also include brakes, lights or an audible warning device.

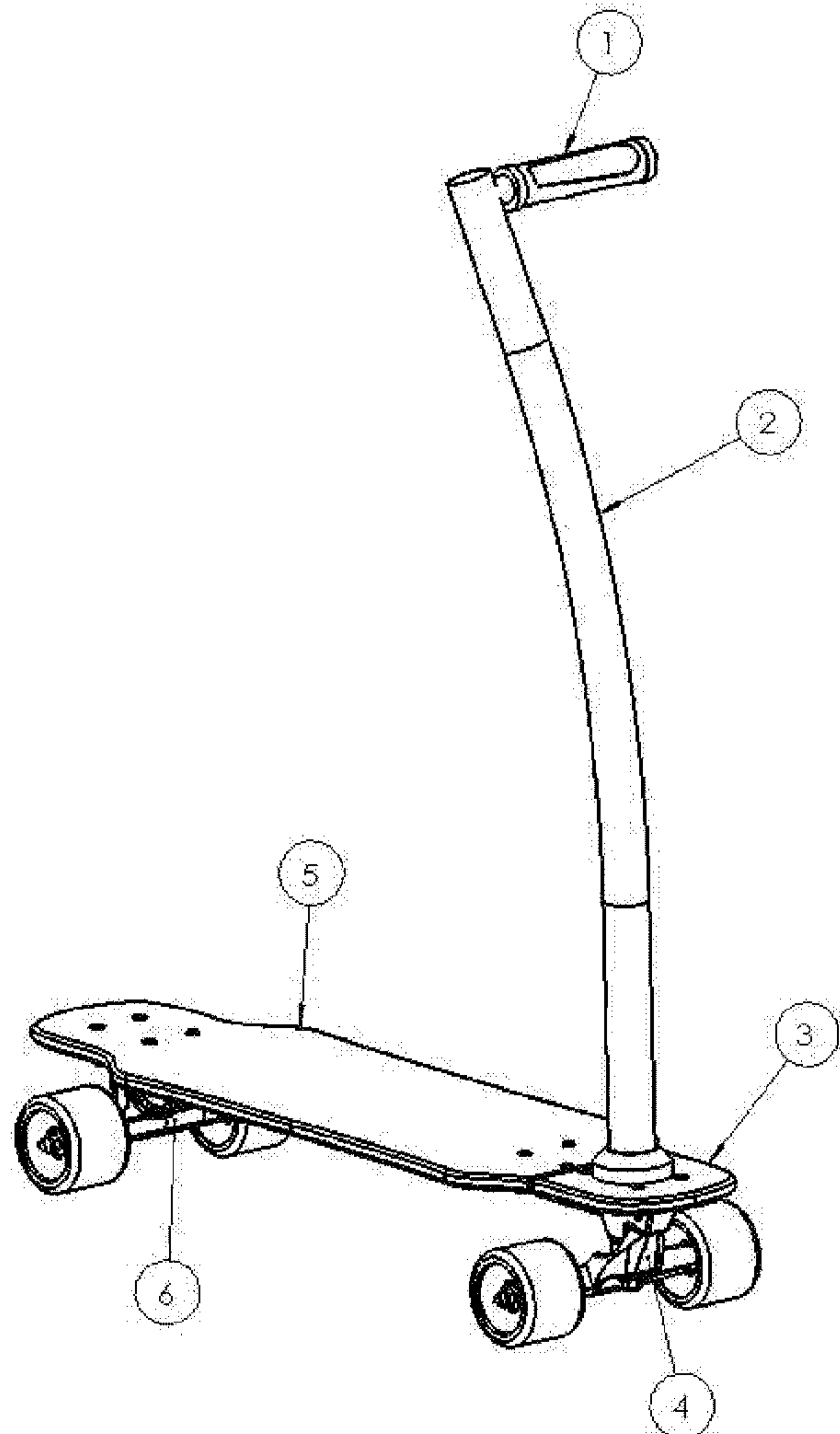


Figure 1

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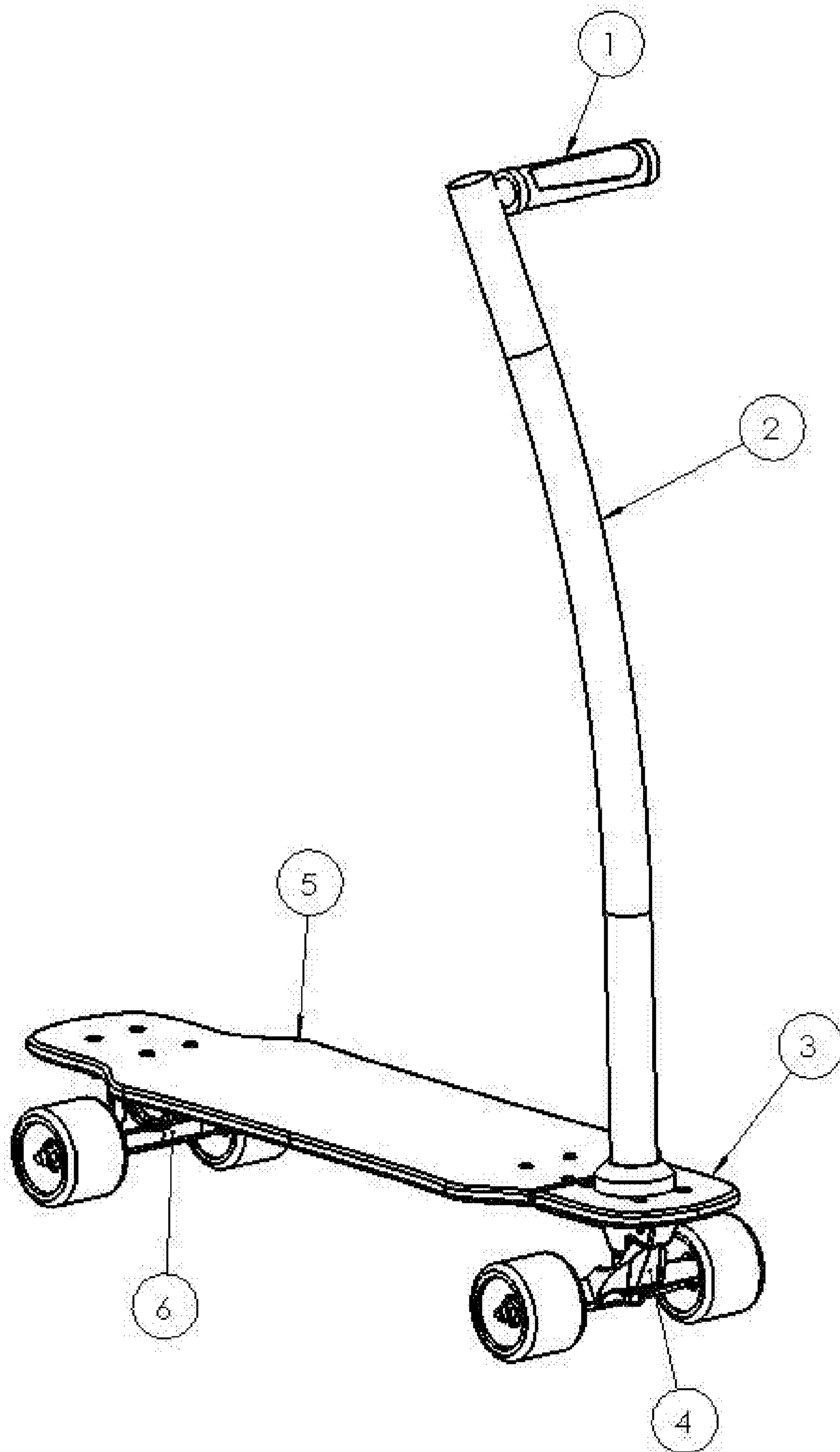


Figure 1

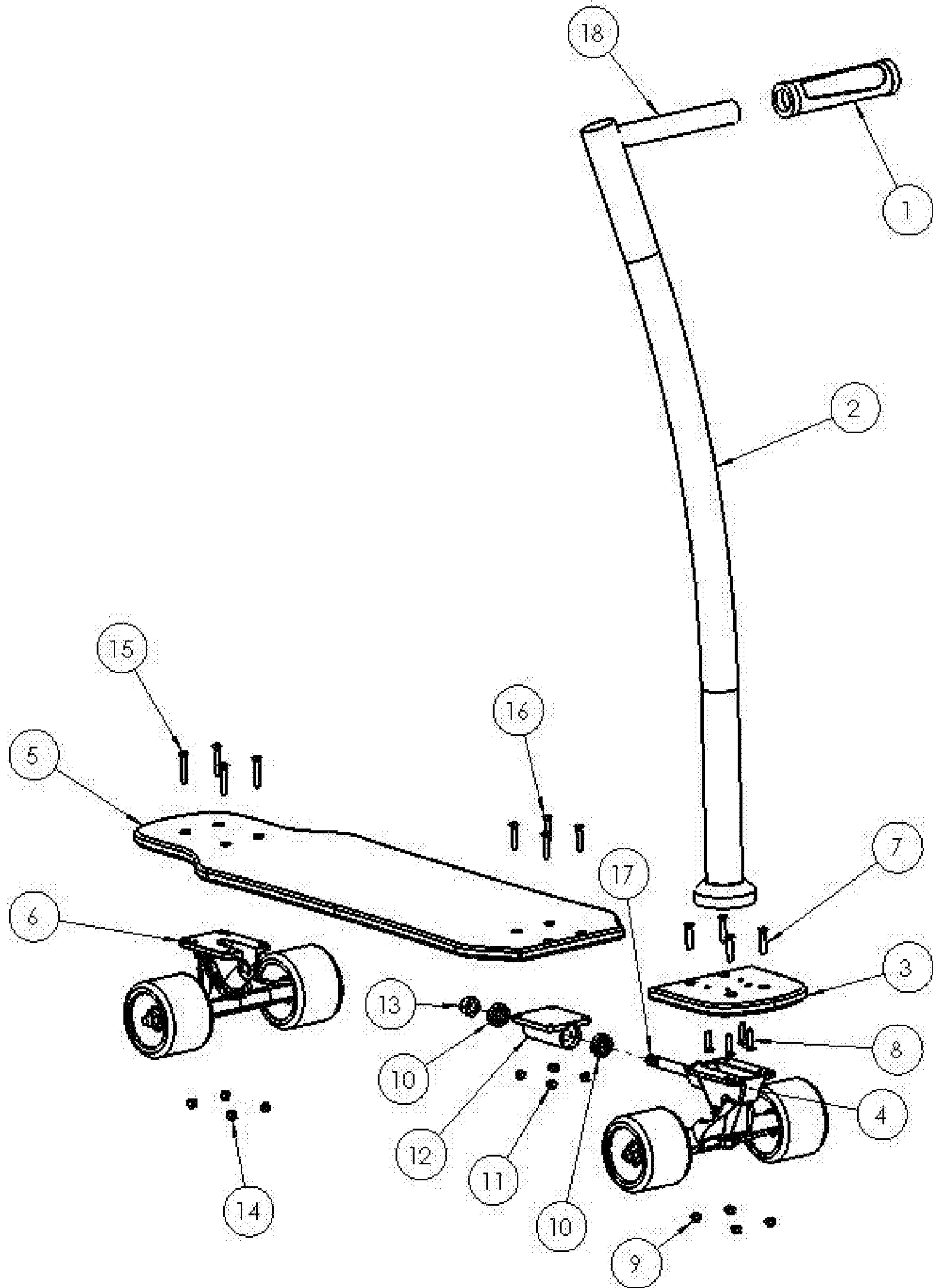


Figure 2

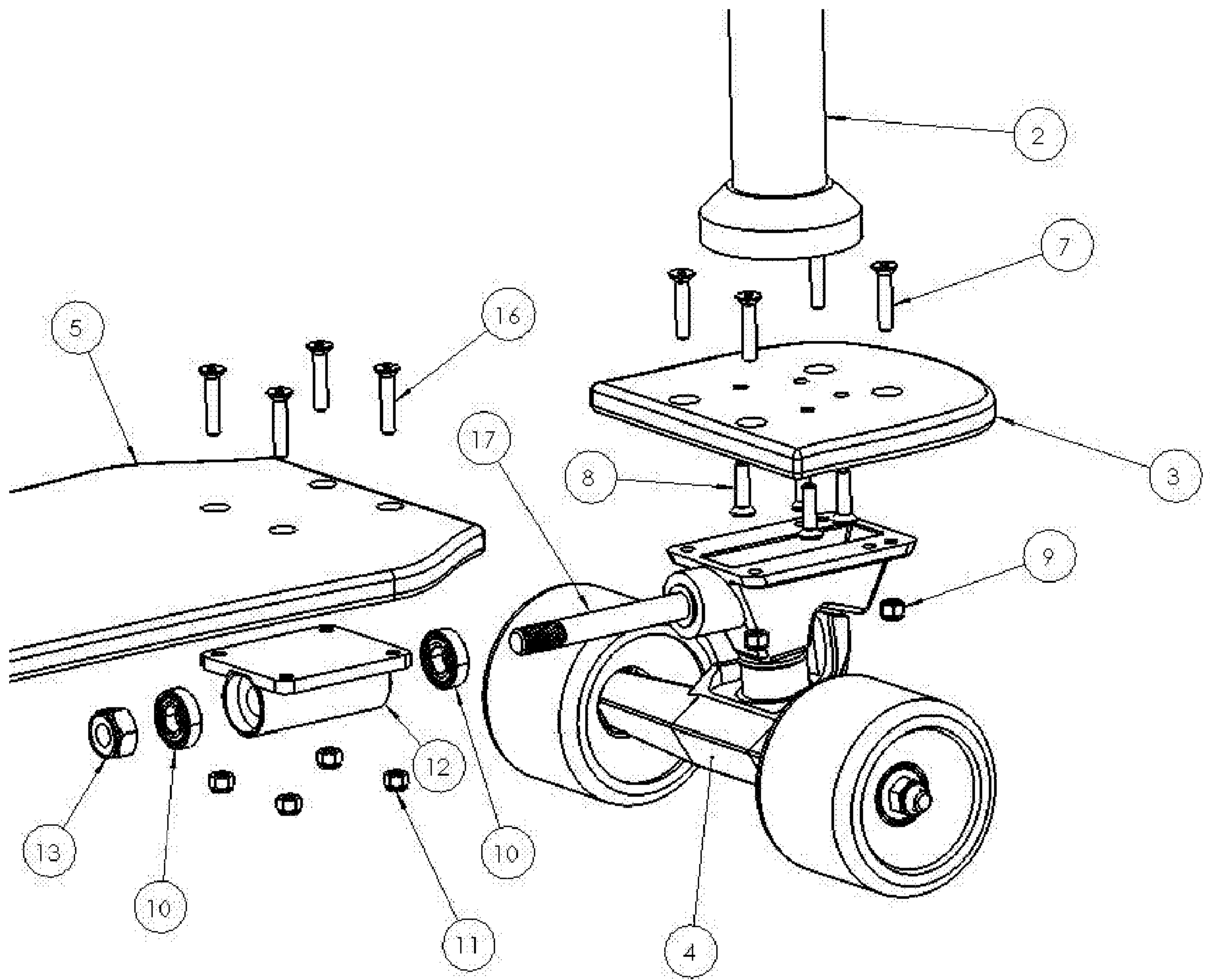


Figure 3

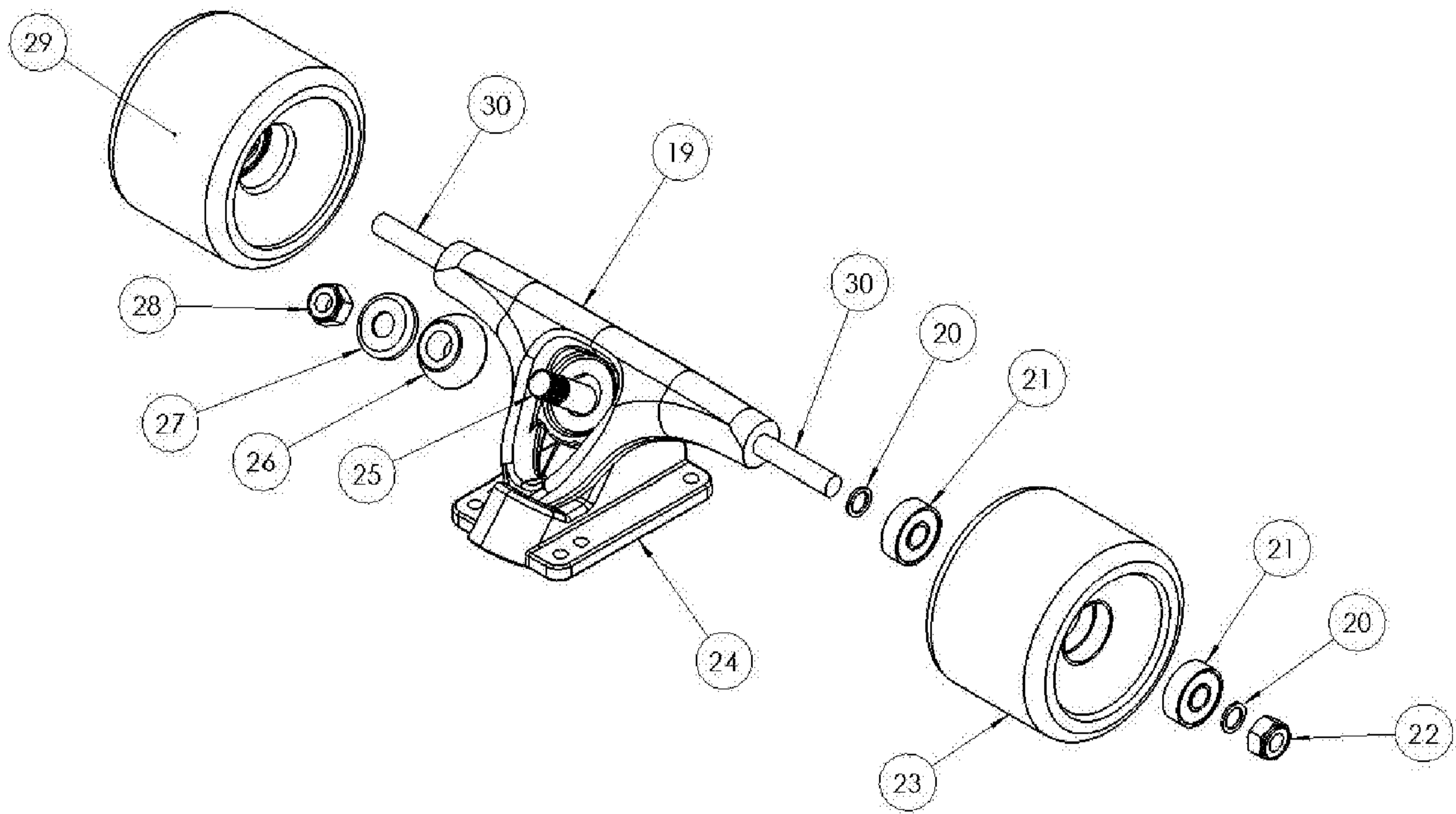


Figure 4

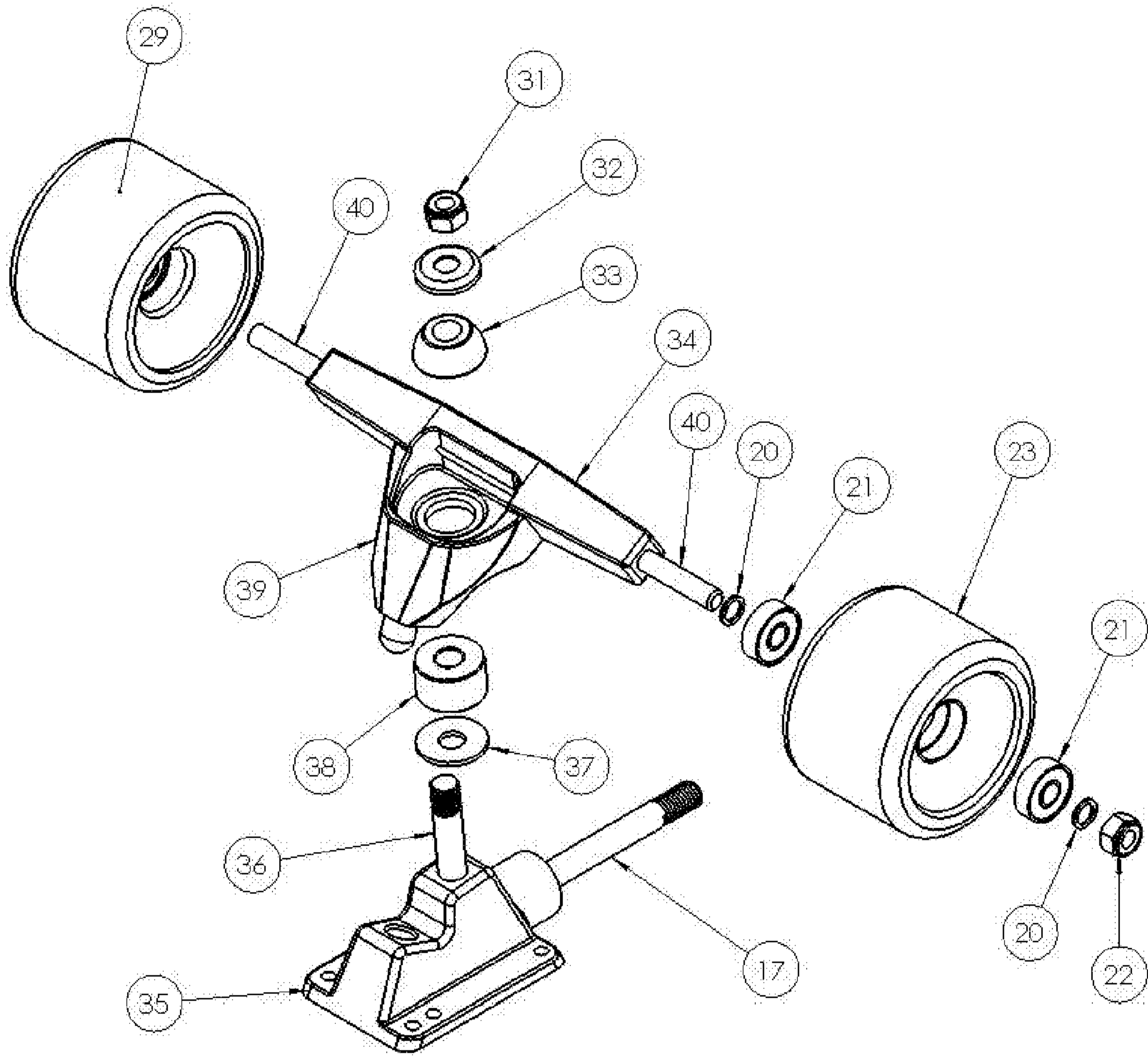


Figure 5

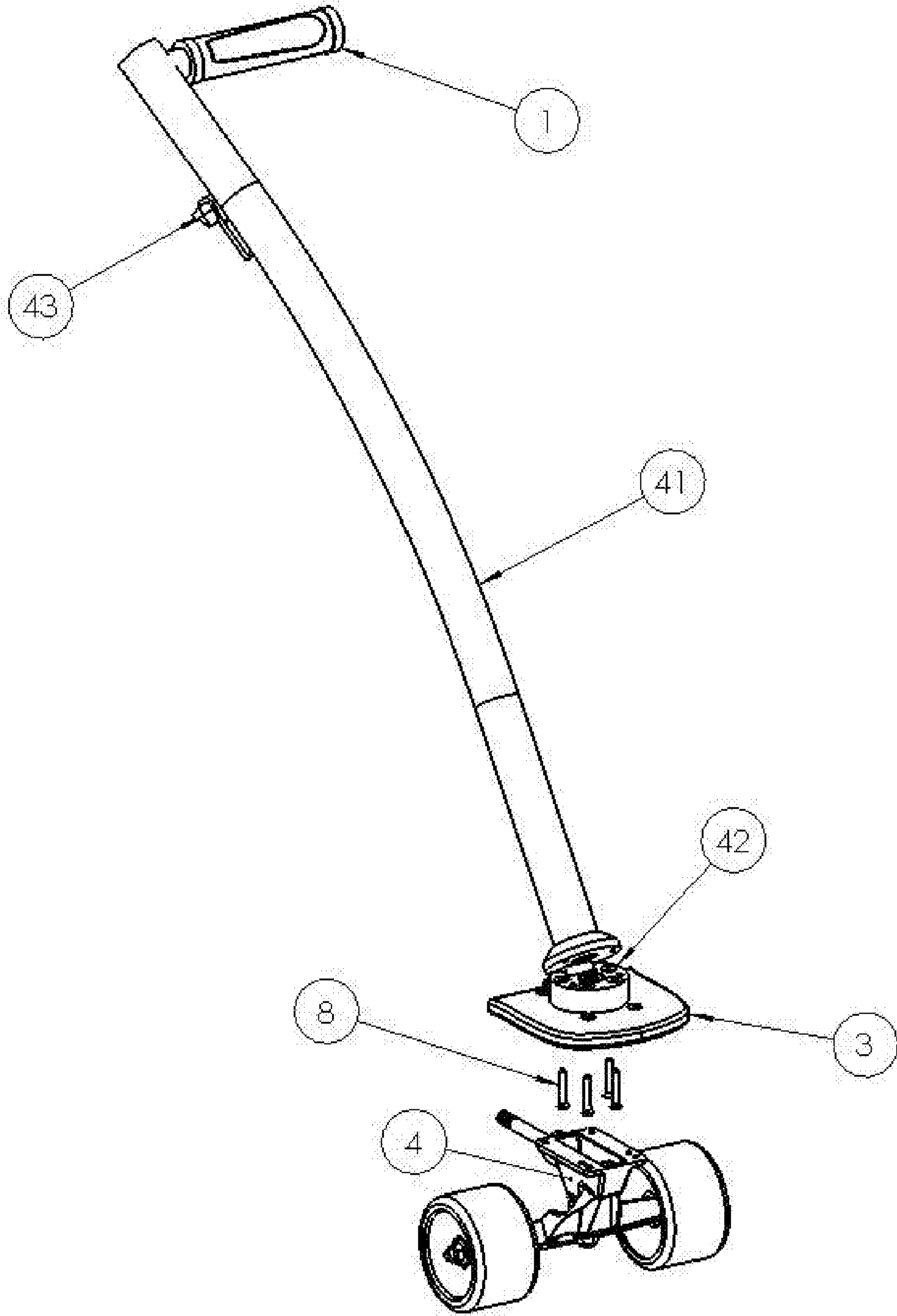


Figure 6

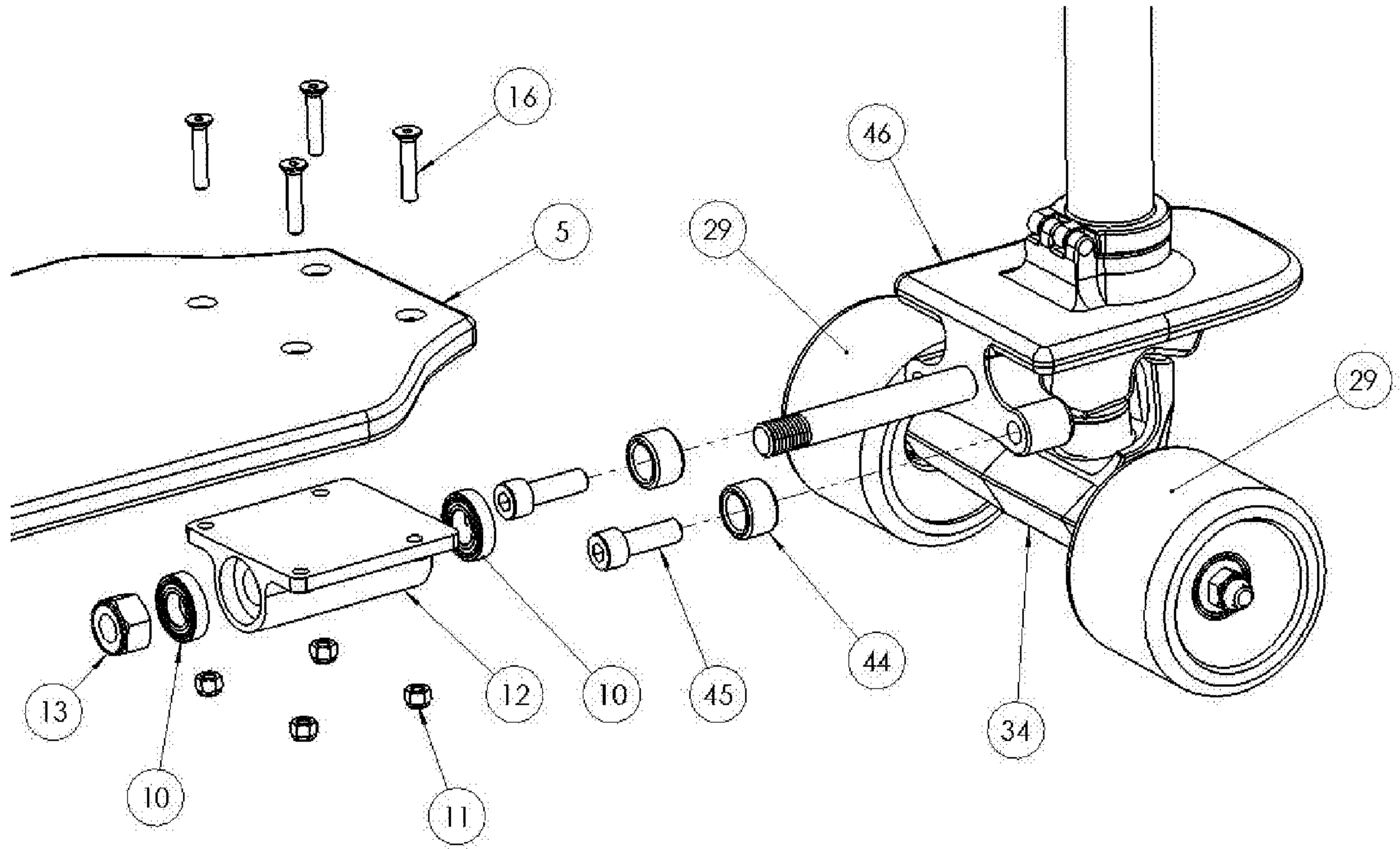


Figure 7

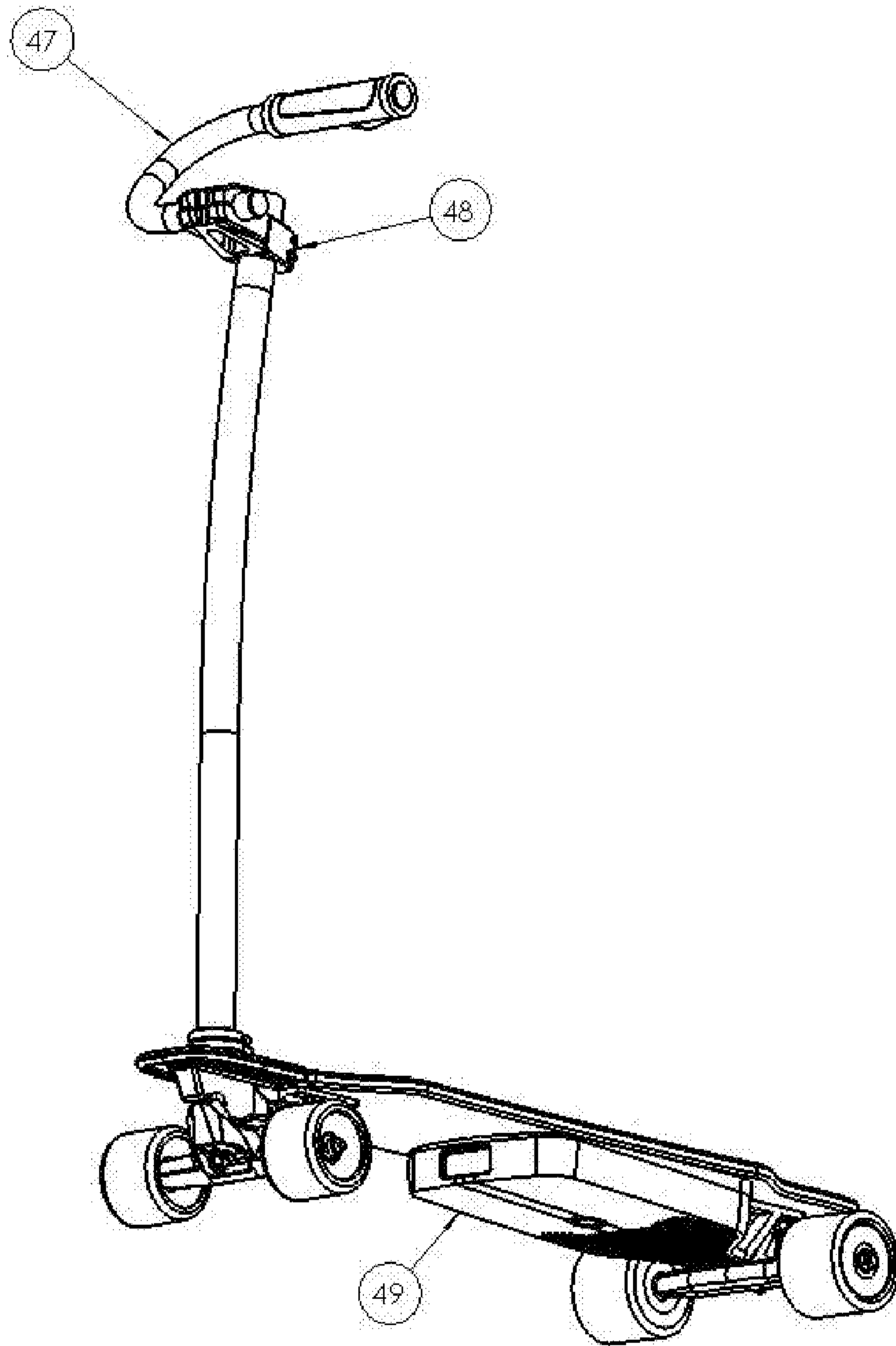


Figure 8

RIDING DEVICE

The invention relates to a riding device, and in particular, a riding device having front and rear trucks that can be steered independently of each other using 'lean steer'.

Skateboards and longboards are very popular for transportation, as a leisure activity and for performing tricks in urban environments.

Steering on common skateboards and longboards is achieved by using both the front and rear trucks simultaneously. With common skateboard and longboard trucks, as the rider laterally shifts their weight and uses their feet to tilt the deck about a longitudinal axis, the truck hanger and wheels turn to steer the device.

When the deck is laterally tilted, the reaction between the wheels and the ground causes rotation of the truck hanger relative to the truck baseplate which in turn causes steering. This happens because the connection between the hanger and baseplate is through a non-vertical axis known as the baseplate angle or truck angle.

In order to achieve smooth turns, both sets of trucks are almost always identical in hanger width, baseplate angle and wheel size. This ensures the board handles predictably and can be ridden both ways.

The angle that the hanger and wheels turn from their rest position is proportional to the angle that the deck is laterally tilted from its horizontal position by the rider. This method of steering is called 'lean steer'.

The amount of steering that is achieved for a given angle of tilt of the deck is determined predominantly by the baseplate angle of the truck. This is the angle of the kingpin relative to the horizontal and is the axis around which the hanger and wheels pivot. A low baseplate angle (of around 40°) requires a smaller force, but a larger level of deck tilt, to turn the hanger and wheels the same amount as with trucks with a higher baseplate angle (around 60°).

Longboards, in particular, allow the rider to make easy carved turns using lean steer, and they achieve this by using trucks with a low baseplate angle.

Longboards also commonly lack a tail, which is used on skateboards to turn the deck while balancing on the rear wheels and pointing the nose to make sharper turns.

Because of this, it is almost impossible to make sharp turns on a longboard at lower speeds. It is also extremely difficult for the rider to manoeuvre their weight to make anything other than longer gradual turns at higher speeds.

Furthermore, it is very difficult to steer a skateboard or longboard while propelling the board forwards. This is because the rider stands with only one foot on the deck, which is predominantly positioned in the centre of the board, thus preventing much lean steer.

Conversely, with scooters, as with bicycles, steering is achieved by simply turning the front wheel. This method of steering is called 'turn steer'. By turning the handlebars, the rider causes rotation of the down-tube and forks, and thus, turning of the front wheel about the central axis of the steering column. The rider will need to lean into the turn for balance, but at both low and high speeds, it is the front wheel turning relative to the rear wheel which makes these devices turn.

On devices with turn steer, the rider usually determines the direction of the steering wheels through input from the hands, the rider therefore has a lot more feel and control over the angle of the steering wheels than when using the feet and bodyweight position to tilt a deck.

The different steering mechanisms of skateboards and scooters have been combined to provide various riding devices.

US 2005/140108 A1, for example, describes a scooter with a skateboard truck assembly positioned at the front of the scooter and a single wheel at the rear. This product uses lean steer of the handlebars and deck, simultaneously, to turn the front wheel assembly while having no steering on the single rear wheel.

In addition, WO 02/096527 A2 describes a riding device comprising a deck with twin wheels at the front and rear. The rider can steer the front wheels by rotating the handlebars within the steering column (i.e., 'turn steering'). The rear wheels are steered by the rider tilting the deck (i.e., 'lean steering').

There is an on-going need for riding devices that can achieve a greater level of manoeuvrability and agility at both low and high speeds.

In a first aspect, the invention provides a riding device comprising a deck for supporting a rider; a steering portion pivotably mounted to the deck for rotation with respect to the deck about a generally horizontal and longitudinal axis; a steering handle extending from the steering portion and operable by a rider to pivot the steering portion about the generally horizontal and longitudinal axis; a front truck attached to the steering portion so as to cause a steering effect when the steering portion is pivoted about the generally horizontal and longitudinal axis; and a rear truck attached to the deck so as to cause a steering effect when the deck is tilted about the generally horizontal and longitudinal axis by a change in weight distribution by a rider.

Advantageously, by providing front and rear trucks that can be steered independently of each other, a riding device in accordance with the present invention allows a higher level of manoeuvrability for the rider than with the prior art assemblies, especially at lower speeds, using lean steer only.

Additionally, by introducing independent front and rear lean steer, and in particular, by using lean steer on the front truck actuated by lateral movement of a steering handle, faster, sharper and more controlled turns become possible. This is because steering the device does not require the rider to shift their bodyweight laterally to tilt the deck, and high levels of steering control is easier to achieve using a handle compared to tilting the deck with the feet.

Furthermore, the invention provides a means for the rider to easily achieve more extreme manoeuvres. Not only can the invention steer like a traditional skateboard or longboard (i.e., if both the front and rear truck hangers are rotated to steer in the same arc), but by disconnecting the trucks and allowing independent steering, more combinations of front and rear hanger direction are possible, giving the option of tight turns, crabbing, drifting and skidding.

Moreover, by separating the front and rear steering, the riding device will behave more like a snowboard, where twisting the board along its longitudinal axis with the feet can provide a similar steering effect, allowing great control over the direction. This is something that has not been seen before on a skateboard or longboard.

Another advantage the invention provides is to allow beginner riders to enjoy the experience of the carving aspect of longboarding while in greater control of turning and balancing than with traditional longboards, through the addition of a steering handle.

Furthermore, the rider is also able to steer the device at the same time as propelling it forwards with one foot as the front steering is independent from the predominantly horizontal deck while being propelled.

The deck of the riding device may be comprised of any suitable material, including wood, metal, plastics or carbon fibre. It is required to support the rider and allow a comfortable riding position. Preferably, the deck is made from plywood and is similar in shape and size to a common longboard. The deck may incorporate a kicktail, be completely flat or be a drop deck.

The rear truck may comprise a baseplate, a hanger, bushings, an axle and a kingpin. In a common skateboard or longboard truck arrangement, the truck hanger is connected to the baseplate via the kingpin (and nut) and may incorporate bushings either side of it to provide a reactive force when in lean steer to return the axle to neutral position.

Preferably, the rear truck is secured to the deck with 4 nuts and bolts which pass through holes in both the deck and the truck baseplate. Alternatively, by moulding, casting or machining the deck, a portion of the rear truck may be incorporated into the deck, allowing the axle or hanger to be connected directly to the deck, and effectively removing the requirement of a separate baseplate.

The steering portion is preferably made from the same material as the deck (e.g., wood, metal, plastics or carbon fibre).

The steering portion may be a body adapted to connect both the steering handle and the front truck. In this arrangement, the front truck and steering handle may be secured to the steering portion using nuts and bolts which pass through holes in the handle, steering portion and the truck baseplate. Alternatively, the steering portion may be the front truck baseplate, a section of the steering handle, or both.

The steering portion is rotatably connected to the deck about a generally horizontal and longitudinal axis in order to allow independent lean steer of the front and rear trucks. Preferably, this connection is provided by a shaft that extends from the front truck and is rotatably journalled in a bearing device connected to the deck. The shaft may be formed on the front truck by moulding or casting, or may be a separate component connected to the front truck or steering portion with mechanical fasteners, such as nuts and bolts. Preferably,

the bearing device is connected to the deck using nuts and bolts, however, the bearing device could form part of the deck if it is moulded or cast.

In an alternative embodiment, the shaft may extend from or be connected to the deck and be journalled in a bearing device connected to or being part of the steering portion or front truck.

Alternatively, the deck and the steering portion may be rotatably connected about a generally horizontal and longitudinal axis by a hinge, a spring or a flexible material connection. These connections can all be arranged to allow independent lean steer of the front and rear trucks.

Preferably, the front truck comprises a baseplate, a hanger, bushings, an axle and a kingpin. The presence of the steering handle means that the front truck baseplate angle can be higher and closer to vertical than on a typical skateboard or longboard, allowing tighter turns at low speed while maintaining stability at high speeds. Introducing a front truck with a very high baseplate angle, for example, between 75° and 89° , allows the front wheels to steer more with the same level of baseplate tilt. This becomes possible with independent steering and the addition of a steering handle as the rider will have both more accuracy over the steering direction and will be able to apply a greater tilting force than when using the feet only.

Alternatively, the front truck could be designed to turn the front wheels with a different set-up to a common skateboard or longboard truck. For example, each wheel could pivot about its own axis or a common axis using a mechanical linkage, such as a gear rack or using tie rod joints, which would turn the wheels when the steering portion is rotated about the generally horizontal and longitudinal axis.

Preferably, the riding device comprises a pair of skateboard wheels, longboard wheels or off-road wheels mounted on the front and rear trucks. The off-road wheels may be solid or be inflated with air to allow use on grass or more rough terrain than tarmac.

Alternatively, skis may be mounted on the front and rear trucks to allow use on snow or water. For use on ice, skates or metal runners may be mounted on the front and rear truck.

The steering handle is the connection between the rider and the steering portion. It may be made from any suitable material such as metal, wood, plastics or carbon fibre, and may be operated in any comfortable position or orientation for the rider.

The length of the steering handle may be adjustable to cater for different size riders. This may be achieved, for example, with a telescopic tube. Alternatively, the location of the portion the rider holds may be adjusted through an adjustable clamp or stem.

To facilitate storage and transportation of the riding device, the steering handle may be moveable between a riding position and a storage position, wherein, in the storage position, the upper end of the steering handle folds down towards the deck. This can be achieved, for example, by connecting the steering handle to the steering portion with a hinge, pivoting mechanism, flexible material or by disconnecting it all together.

Preferably, the riding device includes a means for locking the steering handle in the storage position, such as, a pin, a latch, a clip or by tightening with threaded components.

The handle may be locked in its folded position with a clip or clamp at the upper end to secure it to the deck and prevent deck rotation. The handle may then be used to aid with transport when not in use to pull or push the device when walking, rolling on the front wheels only.

To help a rider to balance, the steering handle may be fixed in one or more riding positions, such that, in use, the angle between the steering handle and the horizontal remains constant. This means that the rider can lean on the steering handle to better steady themselves. Preferably, the fixed angle between the steering handle and the horizontal is from 45° to 90° , more preferably, from 80° to 88° , and most preferably from 82° to 87° .

Alternatively, the steering handle may be left unlocked when riding to allow more freedom of movement for the rider. In this embodiment, the steering handle is free to move between its fully folded position to a fully unfolded position with the handle at a maximum of 90° to the horizontal. This would not affect lean steering as only lateral (i.e., side-to-side) movements will pivot the steering portion about the generally horizontal and longitudinal axis.

The steering handle may include a gripping portion at its distal end. Preferably, the gripping portion is arranged so as to project perpendicular to the length of the steering handle, for example, horizontally across the width of the device. The gripping portion may be covered with a grip made of a rubber, leather or metal material so as to be comfortable for the rider. Preferably, the gripping portion is designed to be held with one hand, so as to allow the natural riding style of a skateboard or longboard, i.e., standing to face the side of the board.

Alternatively, the gripping portion may be formed and arranged to be held with two hands with a T-bar style, as with common scooters.

The riding device may include stops for limiting the rotation of the deck about the generally horizontal and longitudinal axis to a maximum angle. For example, the deck may be permitted to rotate to a maximum of 90°, preferably 60°, and more preferably 40°, either side of horizontal. Alternatively, the deck may be allowed to rotate fully, permitting 360° rotation about the generally horizontal and longitudinal axis.

The riding device may be electrically powered, for example, with belt drives or hub motors providing power directly to the front or rear wheels using a motor controller and a rechargeable battery as seen with common electric skateboards. This drive input could be provided by an interface on the steering handle or by a remote device. The rider interface may use electric or mechanical controls.

To improve safety, the riding device may include brakes, lights and/or an audible warning device, such as a bell or a horn. Such safety features may be activated using an interface on the steering handle or by a remote device. The rider interface may use electric or mechanical controls.

All features described in connection with any aspect of the invention can be used with any other aspect of the invention.

The invention will be further described with reference to the accompanying drawings in which:

Figure 1 is an isometric view of a riding device in accordance with the invention.

Figure 2 is a part-exploded isometric view of the riding device of Figure 1, showing detail of how the components are connected.

Figure 3 is a part-exploded isometric view of the connection between the front and rear sections of the riding device of Figures 1 and 2.

Figure 4 is a part-exploded isometric view of a common truck assembly.

Figure 5 is a part-exploded isometric view of a front truck assembly in accordance with the invention.

Figure 6 is a part-exploded isometric view of the front end of a riding device in accordance with the invention, having a folding steering handle and including the front truck assembly of Figure 5.

Figure 7 is a part-exploded isometric view of the connection between the front and rear sections of an alternative riding device with rotation stops in accordance with the invention.

Figure 8 is an isometric view of the underside of an electric riding device in accordance with the invention, including a battery pack and an adjustable gripping portion.

The riding device shown in **Figures 1-3** includes a rear truck assembly **6** attached to the underside of a riding deck **5** by nuts **14** and bolts **15**. At the front end of the deck **5**, a steering portion **3** is provided. The steering portion **3** is pivotably mounted to the deck **5** via a front truck assembly **4** which is connected to the underside of the steering portion **3** by bolts **7** and nuts **9**. The steering portion is also connected to a fixed-position steering handle **2** by bolts **8**. The distal end of the steering handle **2** includes a gripping portion **18** covered by a grip **1**, designed to be held by the rider with one hand.

The pivotable mounting between the deck **5** and the steering portion **3** is provided by a shaft **17** that extends from the front truck assembly **4** and is rotatably journalled in a bearing device **12** attached to the underside of the deck **5** by nuts **11** and bolts **16**. Bearings **10** are provided on either side of the bearing device **12** so as to allow the front truck assembly **4** to rotate independently from the deck **5**. The shaft **17** of the front truck assembly **4** is secured in the bearing device **12** with a nut **13**.

Figure 4 shows a part-exploded view of a common longboard truck assembly (item **6** in Figures 1 and 2).

It shows the bearings **21** that are inserted into the wheels **23** before being secured to the axle **30** of the hanger **19** by nut **22** with a washer **20** either side. The hanger **19** is connected to the baseplate **24** using a top washer **27** and kingpin nut **28** on the kingpin **25** which forms part of the baseplate **24**. To react against turning forces and to return the

hanger **19** to a neutral position, a top bushing **26** and a bottom bushing (not visible in diagram) are positioned either side of the hanger **19**.

Item **29** shows a wheel assembly which incorporates two washers **20**, two bearings **21** and a nut **22**.

Figure 5 shows a part-exploded view of a front truck assembly in accordance with the invention (item **4** in Figures 1, 2 and 3).

A wheel assembly **29** which consists of two washers **20**, two bearings **21** and a nut **22** is connected to the hanger axle **40**. The hanger **34** is secured to the baseplate **35** via the kingpin **36** and kingpin nut **31**. Above the hanger **34** are a top bushing **33** and top washer **32**, below are the bottom bushing **38** and bottom washer **37**. Also detailed is the rotation shaft **17** which is part of the baseplate casting in the preferred embodiment.

Figure 6 shows a part-exploded isometric view of the front portion of a riding device in accordance with the invention, with a folding steering handle **41**.

The folding steering handle **41** is attached via a hinge **42** to the steering portion **3** using bolts **8**. A clip **43** at the upper end of the handle is used to connect to the deck **5** when in the stored position.

Figure 7 shows a part-exploded isometric view of another embodiment of the riding device with a cast or moulded steering portion **46**.

In this embodiment, the steering portion **46** forms part of the front truck baseplate and the hinge for the handle. It also incorporates soft rotation stops **44** which are connected to the steering portion **46** with bolts **45**. When in position, these stop the deck **5** from rotating past a set angle to prevent over-rotation when in use or transit.

Figure 8 shows an isometric view from below another preferred embodiment of an electrically powered riding device.

A battery and drive unit **49** is connected using nuts and bolts to the deck **5** to power the rear wheels of the device. Also detailed is an adjustable height gripping portion **47** which is connected to the handle with a stem clamp **48**.

Whilst the invention has been described with reference to a preferred embodiment, it will be appreciated that various modifications are possible within the scope of the invention.

In this specification, unless expressly otherwise indicated, the word 'comprising' is used in the sense of 'including' rather than in to mean 'consisting of'. All prior teachings acknowledged above are hereby incorporated by reference. No acknowledgement of any prior published document herein should be taken to be an admission or representation that the teaching thereof was common general knowledge at the date hereof.

Claims:

1. A riding device, comprising:
 - a deck for supporting a rider;
 - a steering portion pivotably mounted to the deck for rotation with respect to the deck about a generally horizontal and longitudinal axis;
 - a steering handle extending from the steering portion and operable by a rider to pivot the steering portion about the generally horizontal and longitudinal axis;
 - a front truck attached to the steering portion so as to cause a steering effect when the steering portion is pivoted about the generally horizontal and longitudinal axis; and
 - a rear truck attached to the deck so as to cause a steering effect when the deck is tilted about the generally horizontal and longitudinal axis by a change in weight distribution by a rider.
2. A riding device as claimed in Claim 1, comprising a pair of skateboard wheels, longboard wheels or off-road wheels mounted on the front and rear truck.
3. A riding device as claimed in Claim 1, comprising skis, skates or metal runners mounted on the front and rear truck.
4. A riding device as claimed in Claim 2, comprising means for electrically powering the wheels.
5. A riding device as claimed in any preceding claim, wherein the steering handle is moveable between a riding position and a storage position, and wherein, in the storage position, the steering handle is arranged so as to project substantially parallel to the generally horizontal and longitudinal axis.

6. A riding device as claimed in Claim 5, comprising means for locking the steering handle in the storage position.
7. A riding device as claimed in Claim 5 or Claim 6, comprising means for locking the steering handle in one or more riding positions, such that, in use, the angle between the steering handle and generally horizontal and longitudinal axis remains constant.
8. A riding device as claimed in any preceding claim, wherein the steering handle is movable between and operable in a plurality of riding positions.
9. A riding device as claimed in any preceding claim, comprising stops for limiting rotation of the deck about the generally horizontal and longitudinal axis to a maximum angle.
10. A riding device as claimed in any preceding claim, comprising brakes, lights and/or an audible warning device.



Application No: GB1911031.1

Examiner: Mrs Margaret Phillips

Claims searched: 1-2

Date of search: 10 February 2020

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1 & 2	US 2013/001909 A1 (STILLINGER et al) see paragraph 0048
X	1 & 2	US 2010/072722 A1 (BOYD ET AL) see paragraphs 0048 & 0049
X	1 & 2	US 2009/273152 A1 (CHUNG) See paragraphs 0012 & 0013
X	1 & 2	US 6367828 B1 (MANDIC) See column 6 lines 16-25 and all drawings
X	1 & 2	US 6182985 B1 (WANG et al) See column 1 lines 31-40 and all drawings
X	1 & 2	US 2005/140108 A1 (CHEN) See paragraph 0013 and all drawings
X	1 - 2	WO 02096527 A2 (CHUNG) See Figures

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^X :

Worldwide search of patent documents classified in the following areas of the IPC

B62K

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC



International Classification:

Subclass	Subgroup	Valid From
B62K	0003/00	01/01/2006