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(54) **THREE-WHEELED REAR-STEERING SCOOTER**

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B62K 7/02 (2006.01)

(52) **U.S. Cl.** **280/87.021**; 280/266

(58) **Field of Classification Search** 280/7.1, 280/7.15, 87.01, 87.041, 87.043, 87.05, 11.27, 280/828

See application file for complete search history.

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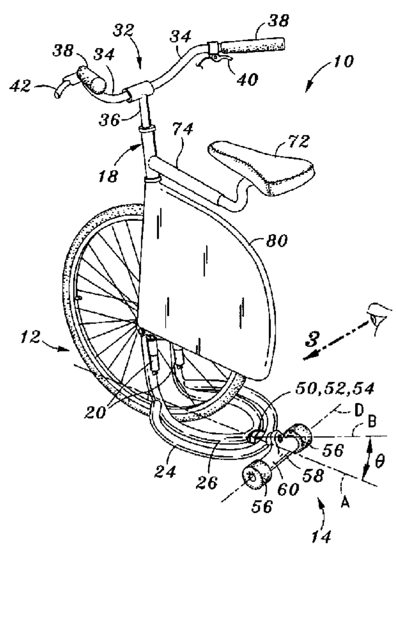
(57) **ABSTRACT**

A three wheeled scooter comprises a chassis having forward and aft ends with a front wheel non-pivotally mounted to the forward end and a pair of rear wheels coaxially mounted to the aft end. The chassis defines a longitudinal axis and includes a support assembly and a handle assembly extending upwardly from the support assembly. The rear wheels are configured to be angularly yawable relative to the longitudinal axis between a neutral position and a yawed position. Steering of the scooter is thereby effectuated by angular yawing of the rear wheels relative to the longitudinal axis such as by asymmetric loading of one of opposing sides of the support assembly.

16 Claims, 2 Drawing Sheets



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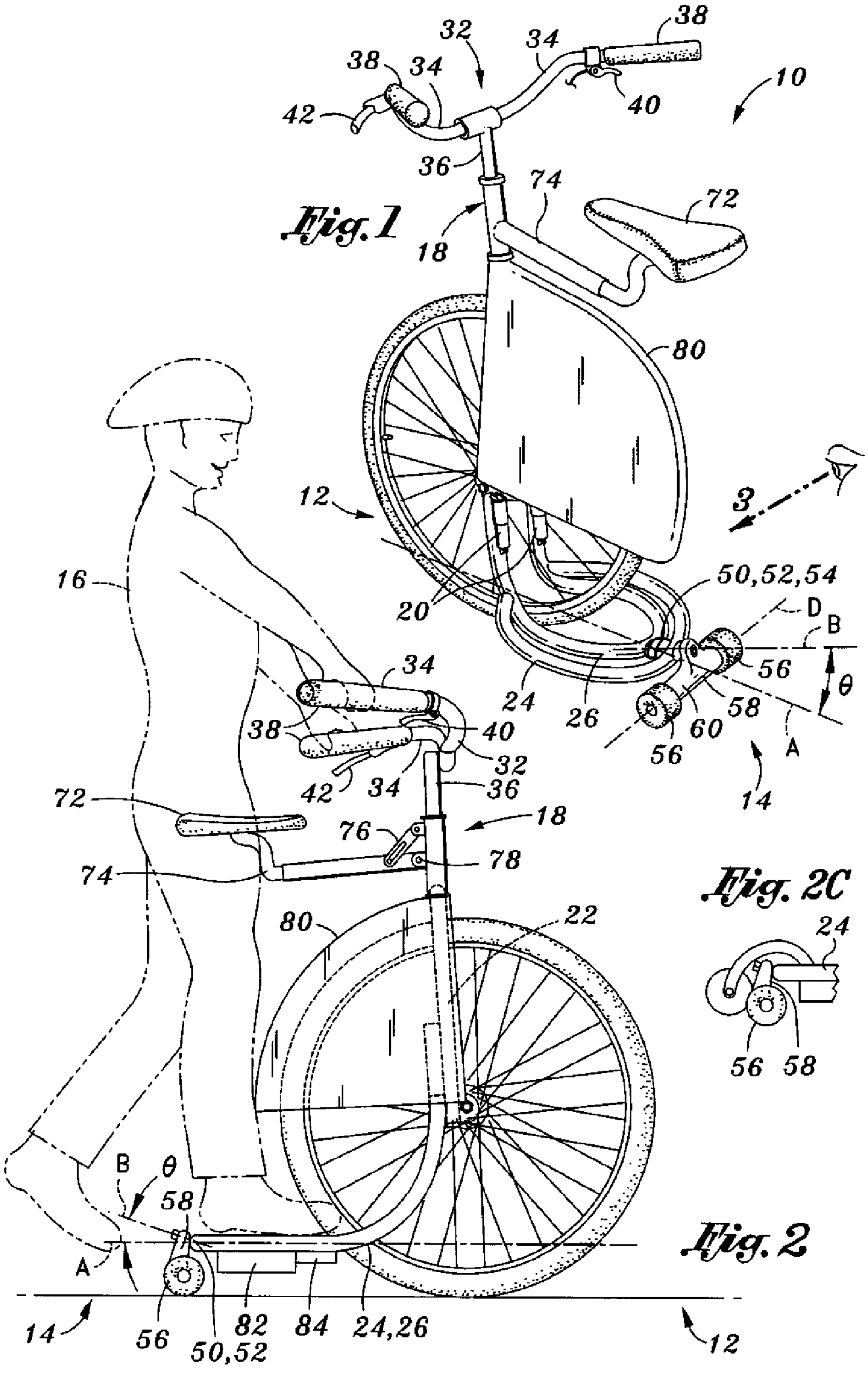

Fig. 1

Fig. 2C

Fig. 2

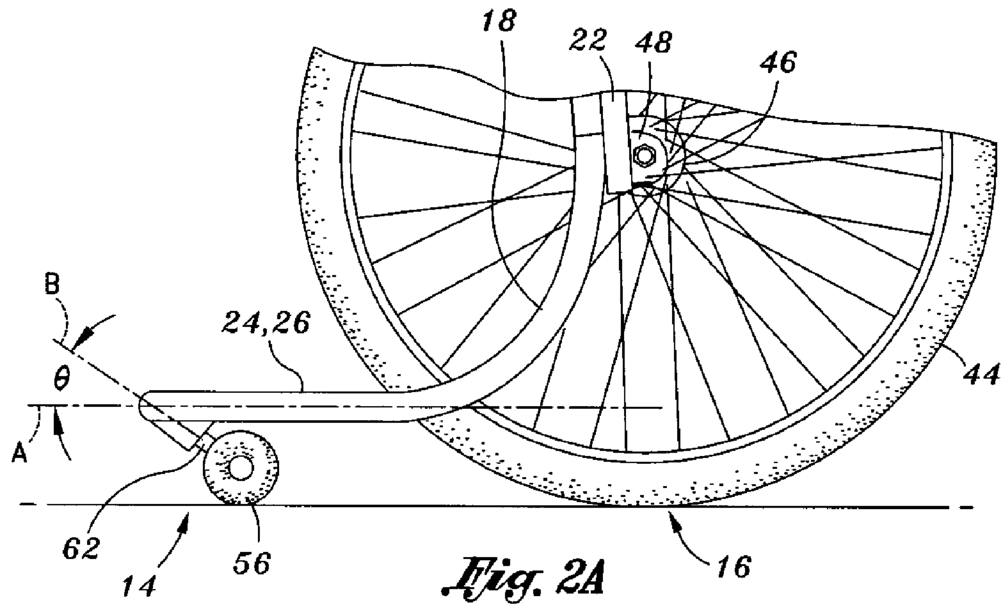

Fig. 2A

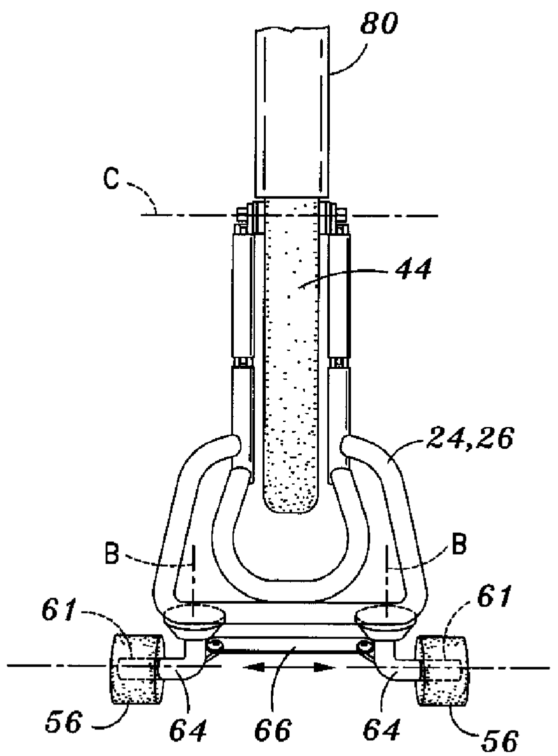

Fig. 2B

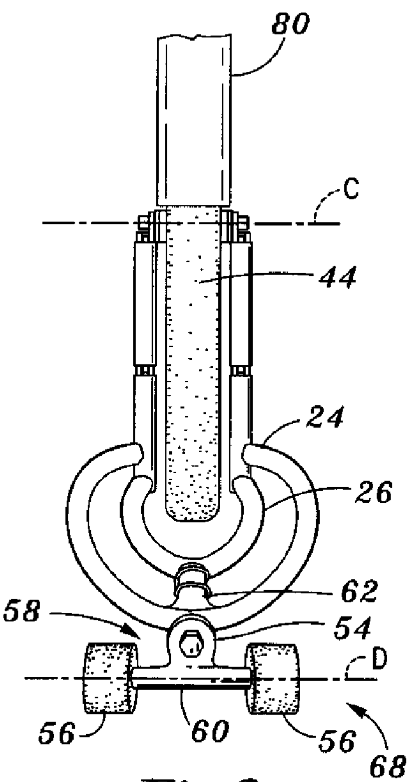

Fig.3

THREE-WHEELED REAR-STEERING SCOOTER

CROSS-REFERENCE TO RELATED APPLICATIONS

This is a continuation application of U.S. patent application Ser. No. 11/713,947, filed on Mar. 5, 2007, now U.S. Pat. No. 7,540,517, issued on Jun. 2, 2009, the entire content of which is expressly incorporated herein by reference.

STATEMENT RE: FEDERALLY SPONSORED RESEARCH/DEVELOPMENT

(Not Applicable)

BACKGROUND

The present invention relates generally to wheeled vehicles and, more particularly, to a uniquely configured three-wheeled, rear-steering scooter having a single front wheel and a pair of smaller-diameter rear wheels wherein the scooter is specifically adapted to be steered by an operator due to angular yawing of the rear wheels in response to lateral rolling or tilting of a chassis to which the rear wheels are pivotally mounted.

Scooters are well known in the prior art and are available in a wide variety of configurations with each configuration possessing certain advantages that allow a rider or operator to perform certain maneuvers that cannot be performed with other scooter configurations. For example, U.S. Pat. No. 6,250,656 issued to Ibarra discloses a scooter having an elongated footboard supported at its rear by a pair of small diameter wheels and at its front end by a large diameter front wheel. The scooter includes positive steering capability via a pivotable front wheel that is steerable by an operator via handlebar assembly. The footboard includes an upwardly angled flat portion located aft of the rear wheels and which is oriented at an angle to allow upward pitching of the scooter in response to the operator stepping on the flat portion such that the operator may perform "wheelies", and allowing the scooter to jump over objects.

U.S. Pat. No. 5,620,189 issued to Hinderhofer discloses a scooter having a frame assembly which includes a footboard at a rear of the frame assembly and a large-diameter front wheel located at a front end of the scooter. The rear of the footboard is supported by at least one unsteerable rear wheel preferably located below the footboard. Alternatively, the scooter may include a plurality of rear wheels which may be arranged in an in-line configuration which provide a plurality of rolling surfaces to facilitate gliding movement over uneven terrain such as stair steps or street curbs. Steering of the scooter is facilitated by means of a handlebar assembly by which a rider may pivot the front wheel and therefore steel the scooter in a conventional manner.

U.S. Pat. No. 6,739,606 issued to Rappaport discloses a dual-footboard scooter provided in a tricycle arrangement having a front wheel of relatively large diameter and being joined to a frame. The frame extends rearwardly in a bifurcated arrangement to form two branches, each of which is supported by a single rear wheel. Each of the branches includes a generally horizontally-oriented footboard supported at its rear end by the rear wheel. An operator may rest one foot on one of the footboards while making pushing contact with the ground in order to propel the scooter forward.

Steering of the scooter is effectuated by the front wheel which is pivotable by means of a handlebar assembly for steering the scooter.

U.S. Pat. No. 6,220,612 issued to Beleski discloses a three-wheeled scooter configured as a "cambering vehicle" having a single steerable front wheel and a pair of rear wheels disposed on separate trailing arms. Each of the trailing arms is articulably to a front column from which the front wheel extends. Forward motion of the scooter is generated by the operator alternating shifting of weight from side-to-side as the scooter travels a sinusoidal path produced by the operator steering the front wheel left and right by means of a handlebar assembly. The simultaneous shifting of weight from one side to the other in combination with the steering of the vehicle produces a series of accelerations under the principle of conservation of angular momentum which results in forward motion of the scooter.

The prior art includes additional alternative scooter configurations in addition to the above described scooter arrangements. A majority of the prior art scooters facilitate directional control of the scooter by means of a pivotable front wheel which is coupled to a handlebar assembly by which the operator may steer the scooter. Furthermore, many of the scooter arrangements of the prior art are configured such that the front and rear wheels are spaced a relatively large distance from one another such that the scooter is incapable of performing short-radius turns. Even further, many of the scooter arrangements of the prior art include conventional bicycle handlebars comprising a pair of laterally outwardly extending arm members which require gripping by both of the rider's hands for effective control and steering of the scooter in a stabilized manner.

As may be appreciated, there exists a need in the art for a scooter providing an operator or rider with the capability to execute turns of varying radii including relatively short-radius turns in order to increase the range of maneuvers that may be performed. Furthermore, there exists a need in the art for a scooter that may be operated by the rider in a standing position but which eliminates the need for steering the scooter by turning a handlebar using the rider's hands.

Additionally, there exists a need in the art for a scooter which provides a means for stabilizing or balancing the rider in order to allow adults as well as children to operate the scooter without the risk of injury as a result of falling from the scooter. Finally, there exists a need in the art for a scooter which is of simple construction, low cost, reduced size and of relatively low weight in order to enhance the scooter's maneuverability and to facilitate transportation and storage of the scooter.

BRIEF SUMMARY

The present invention specifically addresses the above-described needs by providing a three-wheeled, rear-steering scooter having the capability to execute turns of varying radii including relatively short radius turns. The three-wheeled, rear-steering scooter comprises a chassis having a relatively large diameter front wheel fixedly mounted at a forward end of the chassis and a pair of smaller diameter rear wheels pivotally-mounted at an aft end of the chassis. In one embodiment, the scooter is configured to allow steering by angular yawing of the rear wheels relative to the chassis. Such angular yawing is effectuated by asymmetric loading of the chassis which causes lateral rolling of the chassis. The lateral rolling may be induced by uneven weighting of left and right sides of the chassis which, in turn, causes the rear wheels to pivot or yaw for steering control of the scooter.

In its broadest sense, the scooter comprises the chassis, the non-pivotable (i.e., non-steerable) front wheel mounted to the forward end of the chassis and an angularly-yawable pair of rear wheels mounted to the aft end of the chassis. The chassis defines a longitudinal axis extending between the forward and aft ends. The chassis may comprise a generally horizontally-oriented support assembly extending from the forward end to the aft end for supporting a rider or operator in a standing position.

Optionally, the scooter may include a handle assembly located forward of the support assembly and extending upwardly therefrom. The handle assembly may be configured as a single vertical member having a gripping potion (i.e., a hand grip) for gripping by one of the rider's hands. Alternatively, the handle assembly may be configured as a pair of lateral members each having gripping portions similar to the configuration of conventional handlebars. Regardless of its configuration, the handle assembly provides a means for stabilizing the rider or operator of the scooter.

The rear wheels are preferably disposed laterally relative to one another and, as was mentioned above, are specifically configured to be angularly yawable relative to the longitudinal axis. In this regard, the rear wheels are adapted to pivot or yaw between a neutral position and a yawed position. In the neutral position, the axis of the rear wheels oriented perpendicularly relative to the longitudinal axis. In the yawed position, the rear wheels are oriented in a non-perpendicular arrangement relative to the longitudinal axis. Direction control or steering of the scooter is effectuated solely or primarily as a result of angular yawing of the rear wheels between the neutral and yawed positions.

The support assembly is preferably configured to laterally roll about the longitudinal axis. Such lateral rolling may be effectuated by asymmetric loading of one of right and left sides of the support assembly. The asymmetric loading may be induced by the rider applying downward pressure to the left or right side of the support assembly such as by uneven weighting using the rider's feet. This asymmetric loading and lateral rolling of the support assembly induces the angular yawing motion of the rear wheels which causes the scooter to turn.

Preferably, the rear wheels are pivotally mounted to the support assembly by means of a trunnion comprising a rear axle. In one embodiment, the rear wheels are mounted on opposing ends of the axle. The trunnion is attached to the support assembly by means of a pivot shaft which extends upwardly from the rear axle. The pivot shaft interconnects the rear axle to the support assembly. Biasing members may be incorporated into the mounting of the rear axle to the support assembly. The biasing member may provide a self-steering or self-stabilizing characteristic to the rear axle, as will be described in greater detail below.

Ideally, the pivot shaft is oriented in an inclined manner relative to the longitudinal axis. More specifically, the pivot shaft may have upper and lower ends and is inclined such that the lower end is located forward of the upper end. In this manner, the pivot shaft is oriented downwardly along a direction from the aft end of the chassis toward the forward end. The downward inclination of the pivot shaft results in angular yawing of the rear wheels at the same time the support assembly rolls laterally to the right or left. The lateral rolling motion of the support assembly is in proportion to the degree of angular yawing of the rear wheel. The net effect of this combination of motions allows a rider to lean into a turn with greater yaw angles of the rear wheels corresponding to greater amounts of lateral rolling motion of the support assembly.

For example, if the rider wishes to execute a right turn of the scooter, the rider asymmetrically loads the right side of the support assembly resulting in the right side laterally rolling or pivoting downwardly about the longitudinal axis while the left side of the support assembly pivots upwardly. Simultaneously, the rear axle is caused to yaw angularly such that the rear wheel on the right side of the longitudinal axis moves forward while the rear wheel on the left side moves aft. This angular yawing causes a the scooter to be redirected toward the right (i.e., point toward the right) during forward movement of the scooter.

It is contemplated that the trunnion may be configured such that the yawing capability of the rear axle relative to the longitudinal axis is a half-angle of at least about 45°. However, the trunnion may be configured to allow yawing of the rear axle up to half-angles of lesser or greater amounts. A biasing member may optionally be included with the trunnion and is operatively connectable to the trunnion. The biasing member is preferably configured to bias the rear axis toward the neutral position in order to provide a self-steering mechanism. In this manner, the rear axle is urged back toward a non-yawed position (i.e., neutral position) following each turn.

The biasing member further provides a self-stabilizing mechanism for the scooter whereby the rear axle may better resist unwanted wobbling or oscillations in the support assembly when the scooter is traveling at high speed. Even further, the biasing member provides a self-parking feature wherein the support assembly returns to a horizontal or level orientation when the rider dismounts the scooter. The handle assembly will also return to a vertical orientation when the rider dismounts the scooter or when the scooter is stationary.

Optionally, the scooter may include an articulated joint at the forward end of the support or assembly. Alternatively, the articulated joint may be positioned so as to interconnect the support assembly to the handle assembly. Regardless of its specific location on the chassis, the articulated joint advantageously provides an alternative means for facilitating the lateral rolling motion of the support assembly. More specifically, the articulated joint allows for lateral rolling motion of the support assembly upon which the rider stands in a direction opposite that of the handle assembly. The articulated joint may provide an alternative mode of propelling the scooter forward as a result of lateral rolling the support frame out-of-phase with the handle assembly in a manner as will be described in greater detail below.

The scooter may optionally include a suspension system operatively coupled to at least one of the front and rear wheels to absorb shock that would otherwise be transmitted to the rider during travel over uneven terrain. More specifically, the suspension system is preferably configured to allow for vertical deflection of the front and/or rear wheels relative to the chassis as may be desirable when encountering gravel, cracks in pavement, or other natural or manmade obstacles.

BRIEF DESCRIPTION OF THE DRAWINGS

These as well as other features of the present invention will become more apparent upon reference to the drawings wherein:

FIG. **1** is a perspective view of a three-wheeled rear-steering scooter having a front wheel non-pivotally mounted to a forward end of the chassis assembly and a pair of rear wheels pivotally mounted to an aft end of the chassis;

FIG. **2** is a side view of the scooter of FIG. **1** illustrating a seat or perch extending laterally outwardly from the chassis assembly for supporting an operator;

FIG. **2***a* is an enlarged side view of the chassis assembly illustrating an inclined orientation of an axis about which the rear wheels pivot and which facilitates angular yawing of the rear wheels for steering of the scooter;

FIG. **2***b* is an aft view of the rear wheels and illustrating the independent pivotal mounting of each rear wheel and the coupling of the rear wheels to facilitate their angular yawing in unison;

FIG. **2**C is an enlarged view of an aft end of the scooter showing an optional wheelie bar.

FIG. **3** is a rear view of the scooter illustrating a trunnion comprising a rear axle and a pivot shaft interconnecting the rear axle to the chassis;

FIG. **4** is a side view of the scooter illustrating a rider inducing a lateral rolling motion to the chassis to effectuate angular yawing of the rear wheels;

FIG. **4***a* is a top view of the scooter taken along line **4***a* of FIG. **4** and illustrating the yaw angle of the rear wheels relative to the longitudinal axis of the scooter during a turn;

FIG. **5** is a side view of the scooter in an embodiment having a strut member extending downwardly from the handle assembly;

FIG. **6** is a side view of a vertically oriented handle assembly configured for stabilizing an operator of the scooter as compared to the handlebar-like arrangement illustrated in FIGS. **1**, **2** and **4**; and

FIG. **7** is a side view of the scooter in an alternative embodiment wherein the chassis includes an articulated joint to allow lateral rolling motion of a support assembly relative to a front wheel of the scooter.

DETAILED DESCRIPTION

Referring now to the drawings wherein the various showings are for purposes of illustrating preferred embodiments of the present invention and not for purposes of limiting the same, shown in the figures is a three-wheeled rear-steering scooter **10**. In its broadest sense, the scooter **10** comprises a chassis **18** having a front wheel **44** and a pair of rear wheels **56** pivotally mounted to the chassis **18** so as to be angularly yawable to allow for steering of the scooter **10**. As can be seen in FIGS. **1** and **2**, the chassis **18** has a forward end **12** and an aft end **14** and defining a longitudinal axis A extending from the forward end **12** to the aft end **14**. The chassis **18** may include a generally horizontally-oriented support assembly **24** to which the rear wheels **56** may be mounted. The support assembly **24** may comprise a foot support **26** upon which an operator **16** or rider of the scooter **10** may stand such as when riding the scooter **10**.

The front wheel **44** is non-pivotally (i.e., non-steerably) mounted at the forward end **12** of the chassis **18**. The chassis **18** may further include an optional handle assembly **32** which is preferably located forward of the support assembly **24** and which extends upwardly from the support assembly **24** as shown in FIGS. **1-2** and **4-7**. In one embodiment, the handle assembly **32** is rigidly connected by suitable means (e.g., mechanical fasteners, welding, etc.) to the support assembly **24**. However, the support assembly **24** and handle assembly **32** may be formed as a unitary structure.

Alternatively, the handle assembly **32** and support assembly **24** may be interconnected by an articulated joint **30** to allow relative lateral rolling motion therebetween, as will be described in greater detail below. The handle assembly **32** is configured to provide a means by which the rider or operator **16** may be stabilized or balanced in a standing position while riding the scooter **10**. For embodiments where the support assembly **24** and handle assembly **32** are rigidly interconnected, the handle assembly **32** also provides a means for steering the scooter **10** as a result of the rider inducing lateral or sideways motion of the handle assembly **32**. Because of the rigid connection between the handle assembly **32** and the support assembly **24**, lateral rolling motion of the handle assembly **32** is transmitted to the support assembly **24**. The resultant lateral rolling motion of the support assembly **24** induces the angular yawing motion of the rear wheels **56** by which the scooter **10** is steered, as will be described in greater detail below.

As best seen in FIGS. **1** and **2***b*, the rear wheels **56** are mounted on the aft end **14** of the support assembly **24** such that the rear wheels **56** are disposed laterally relative to one another. Mounting of the rear wheels **56** to the support assembly **24** may be facilitated with a trunnion **58** which may comprise a rear axle **60** having a pivot shaft **62** extending outwardly therefrom such as from a mid-point of the rear axle **60**. As shown in FIGS. **1** and **3**, the rear wheels **56** rotate about the rear wheel axes D and are specifically adapted to be angularly yawable relate to the longitudinal axis A between a neutral position **68** (i.e., shown in FIG. **1**) and a yawed position **70** (shown in FIG. **4***a*). Importantly, because the front wheel **44** is fixedly secured to the chassis **18** (i.e., non-pivotably mounted), the steering of the scooter **10** is effectuated primarily or solely by angular yawing or pivoting of the rear wheels **56** relative to the longitudinal axis A.

As can be seen in FIG. **4***a*, the support assembly **24** is configured to roll laterally about the longitudinal axis A. In one embodiment of the scooter **10**, the lateral rolling motion of the support assembly **24** induces the rear wheels **56** to angularly yaw which comprises the steering mechanism for the scooter **10**. For example, an operator **16** may initiate a turn of the scooter **10** by asymmetrically loading one of opposing right and left sides of the support assembly **24** and, due to the orientation of the pivot axis B at pivot axis angle θ, causes the rear wheels **56** to yaw in a counterclockwise direction relative to the longitudinal axis A as best seen in FIG. **4***a*. More specifically, FIG. **4***a* illustrates the counterclockwise yawing of the rear wheels **56** relative to the longitudinal axis A as a result of weighting or loading of the right side of the support assembly **24**.

Referring briefly to FIG. **2**, shown is the operator **16** standing on the foot support **26** with the right leg bearing most or all of the operator's weight. This asymmetric loading on the right side of the support assembly **24** causes the lateral rolling movement which induces the angular yawing movement of the rear wheels **56** to the position shown in FIG. **4***a*. Alternatively, loading of the left side of the support assembly **24** would have the reverse effect of inducing clockwise yawing motion of the rear wheels **56** relative to the longitudinal axis A in order to initiate a left turn. As may be appreciated, the operator **16** may directionally control the scooter **10** during forward travel by varying the asymmetric loading on the right and left sides of the support assembly **24**. The asymmetric loading may be facilitated by merely shifting the operator's weight to the left or right leg.

In one embodiment, such as that shown in FIG. **4***a*, the trunnion **58** upon which the rear wheels **56** are mounted is preferably adapted to provide yawing capability to the rear axle **60** relative to the longitudinal axis A at a half angle of up to about 45°. However, it should be noted that the trunnion **58** may be configured to provide any degree of angular yawing capability. As can be seen in FIGS. **1** and **3**, the rear wheels **56** are preferably mounted on opposing ends of the rear axle **60**.

In a preferred embodiment, the pivot shaft **62** is disposed in a non-vertical and non-horizontal orientation such that asymmetric loading of the support assembly **24** causes the angular yawing of the rear wheels **56**. Even more preferably, the pivot shaft **62** is preferably oriented at pivot axis angle θ such that lateral rolling of the support assembly **24** causes the rear wheel **56** on that side to move forward while the rear wheel **56** on the opposing side moves aft. Such an arrangement allows the operator **16** to lean into the turn at progressively greater amounts in proportion to the extent of the lateral rolling motion.

Advantageously, the ability to lean into the turns allows the operator **16** to counteract the effects of centrifugal force which tend to throw the rider toward the outside of the turning radius. Although the pivot shaft **62** is preferably oriented to allow a rider to lean into the turn (i.e., facilitates movement of the rider's center of gravity toward the inside of the turn radius), it is contemplated that the pivot shaft **62** may be oriented in a variety of other arrangements. For example, the pivot shaft **62** may be oriented such that asymmetric loading of one side of the support assembly **24** results in angular yawing of the rear wheels **56** in an opposite direction.

However, as best seen in FIGS. **1**, **2** and **6**, the preferred arrangement is such that the pivot axis B is inclined at pivot axis angle θ relative to the longitudinal axis A such that the pivot axis B is oriented downwardly along a direction from the aft end **14** toward the forward end **12** of the chassis **18**. More specifically, the pivot shaft **62** has upper and lower ends and is inclined such that the lower end of the pivot shaft **62** is located forward of the upper end of the pivot shaft **62**.

As was earlier mentioned, when the support assembly **24** is laterally rolled to the left or to the right, the inclined pivot shaft **62** allows for mechanical steering of the rear wheels **56** in yaw at a direction opposite the direction of intended turning of the scooter **10**. For example, if the operator **16** wishes to execute a right turn of the scooter **10**, the operator **16** may asymmetrically load the right side of the support assembly **24** which causes laterally downward rolling of the support assembly **24**. This laterally downward rolling of the support assembly **24** causes the rear wheels **56** to turn in an opposite direction. In this manner, the operator **16**, by exerting uneven weighting of the foot support **26**, induces lateral rolling thereof which, in turn, effectuates angular yawing or turning of the rear wheels **56**. The greater the degree of asymmetric loading of the support assembly **24**, the greater the degree of angular yawing (i.e., the smaller the turn radius).

As can be seen in the figures, the handle assembly **32** is located forward of and extends upwardly from the support assembly **24** in a generally vertical orientation. In one embodiment shown in FIG. **6**, the handle assembly **32** includes a vertical arm member **36** which extends upwardly from a pair of down tubes **22** or forks to which the front wheel **44** is mounted. The vertical arm member **36** is configured to be grasped or gripped by the operator **16** for stabilizing and/or balance while riding the scooter **10**. Advantageously, the handle assembly **32** also facilitates lateral rolling of the support assembly **24** due to its rigid connection thereto. In this manner, the operator **16** can initiate steering at the handle assembly **32** by a combination of asymmetric loading of the support assembly **24** and lateral rolling of the handle assembly **32** in order to effectuate quicker rates of yawing of the rear wheels **56**.

Referring still to FIG. **6**, the vertical arm member **36** of the handle assembly **32** may be fitted with a ergonomically shaped gripping portion **38** or a hand grip which the operator **16** may grasp. The chassis **18** may further include an arch-shaped strut member **28** extending from the handle assembly **32**. The strut member **28** is preferably aligned with the front wheel **44** and is connected to the foot support **26** at its lower end. The strut member **28** may add to the overall structural rigidity, torsional stiffness and general strength of the chassis **18**. The added stiffness and strength may be desirable during the performance of certain maneuvers or when operating the scooter **10** on challenging terrain.

The strut member **28** is preferably configured such that when riding the scooter **10**, the operator's legs straddle the strut member **28**. However, the strut member **28** may be altogether eliminated and the chassis **18** provided in the arrangement shown in FIGS. **1** and **2**. In embodiments wherein the strut member **28** is omitted, the support assembly **24** and handle assembly **32** are preferably sized to collectively provide sufficient strength and rigidity to the chassis **18**.

Referring to FIGS. **1**, **2** and **3**, the scooter **10** may further include a biasing mechanism or biasing members **54** operatively connected to the trunnion **58** and configured to bias the rear axle **60** toward the neutral position **68**. As was earlier mentioned, when the rear axle **60** is in the neutral position **68**, the rear axle **60** is oriented generally perpendicularly relative to the longitudinal axis A of the chassis **18**. If included, the biasing members **54** preferably induces a return of the rear wheels **56** from a yawed position **70** as shown in FIG. **4*a*** to the non-yawed or neutral position **68** as shown in FIG. **1**. In this regard, the biasing members **54** resists the lateral rolling or tilt of the support assembly **24** and induces a return of the support assembly **24** to a non-rolled position which provides a desirable stabilizing characteristic to the scooter **10**.

Additionally, the biasing members **54** is preferably configured to provide a progressively higher degree of stiffness or biasing force at progressively greater yaw angles of the rear wheels **56**. The progressively higher stiffness of the biasing members **54** also prevents the support platform from laterally oscillating or wobbling (i.e., from side-to-side) which is important when traveling at high speed. A further benefit provided by the biasing members **54** is a self-standing characteristic when the scooter **10** is stationary or parked such that the handle assembly **32** and front wheel **44** are maintained in a vertical orientation. Overall, the biasing members **54** provides stability to the scooter **10** at low speed as well as at high speed by resisting laterally rolling motion of the support assembly **24**.

The biasing members **54** may be configured in a variety of arrangements including, but not limited to, a rubber element or member secured between the support assembly **24** and the trunnion **58** in order to resist relative motion between the rear axle **60** and the support assembly **24**. Alternatively, a spring **50** or pair of springs may be inserted between the rear axle **60** and the support assembly **24** in order to resist lateral rolling motion. A spring dampener **52** may be further included with the biasing members **54** in order to reduce the spring **50** rate of the biasing members **54** to further stabilize the scooter **10**.

In an alternative embodiment, FIG. **2*b*** illustrates individual mounting of each of the rear wheels **56** by means of a pair of generally vertically-oriented spindles **64**. In particular, the rear wheels **56** are rotatably mounted to an axle **61**. The axles **61** are mounted to the spindles **64**. Each of the spindles **64** defines a pivot axis B about which the rear wheels **56** pivot. As can be seen in FIG. **2*b***, the pair of rear wheels **56** may be interconnected by means of a linkage **66** or tie rod. In this manner, the rear wheels **56** are mechanically coupled to one another such that the rear wheels **56** may yaw in unison about their corresponding pivot axes B.

FIG. **2*b*** further illustrates a control arm secured to each of the spindles **64** for interconnecting the rear wheels **56** by means of linkage **66** or tie rod. At least one of the spindles **64** may include a steering arm (not shown) attached to one of the rear wheels **56**. Pivoting motion provided to one of the rear wheels **56** by the control arm is, in turn, transferred to the other one of the rear wheels **56** by means of the linkage **66**. Steering of the scooter **10** may then be effectuated by a foot-actuated or hand-actuated steering mechanism such as a lever (not shown) which induces pivoting motion at the control arm and, which is then transferred to the rear wheels **56**.

Referring briefly to FIG. **1**, the scooter **10** may further include a suspension system **20** which is operatively coupled to at least one of the front and rear wheels **44**, **56**. The suspension system **20** is preferably adapted to allow for vertical deflection of the front **44** and/or rear wheels **56** relative to the chassis **18** such as may occur when riding upon uneven terrain or when encountering small obstacles such as gravel, cracks in pavement or expansion joints in sidewalks. The suspension system **20** may include a pair of spring mechanisms such as shock absorbers which may optionally further include a dampener **52** in order to control the rebound rate and dampen oscillations of the spring mechanisms.

As shown in FIG. **1**, the suspension system **20** may comprise a shock absorber type of assembly incorporated into each of the down tubes **22** on opposing sides of the front wheel **44**. Each of the shock absorbers may terminate at a flange **48** located on each of the down tubes **22**. The flange **48** supports hub **46** of the front wheel **44** with the front wheel **44** being rotatable about front wheel axis C. Alternatively, the suspension system **20** may be configured in other arrangements such as, for example, a spring **50** and/or dampener **52** unit incorporated into the vertical arm member **36** located directly above the down tubes **22**. It is further contemplated that the rear wheels **56** may include a suspension system **20** between the support assembly **24** and the trunnion **58**, for example, in order to allow for vertical deflection of the rear wheels **56** relative to the chassis **18** such as may occur when the rear wheels **56** encounter uneven terrain.

Referring to FIG. **4**, shown is the scooter **10** with the handle assembly **32** wherein the operator **16** may grasp at least one or both of the lateral arm members **34** for stabilization during straight and level riding as well as during performance of turning maneuvers. Each of the arm members **34** may be provided with a gripping portion **38** in order to facilitate secure grasping by the operator's hands.

Although handle assembly **32** appears similar to conventional handlebars, it should be emphasized that the front wheel **44** is non-pivotally secured to the chassis **18** and therefore provides no steering capability as conventionally exists in a bicycle. In this regard, steering of the scooter **10** is effectuated primarily and solely by angular yawing of the rear wheels **56** in response to lateral rolling of the support assembly **24** as a result of weight shifting and/or as a result of lateral motion of the handle assembly **32** from side-to-side. The handle assembly **32** are preferably located at a height suitable for convenient grasping by the operator **16** in the standing or sitting position. It is contemplated that a height adjustment feature may be included in the handle assembly **32** in order to accommodate riders of different sizes. Furthermore, the lateral extending arm members **34** may be provided in an interchangeable configuration in order to allow mounting of handle assemblies of differing widths, shapes and/or angular orientation.

Referring briefly to FIGS. **1** and **2**, the scooter **10** may further include a seat or perch **72** supported by a perch post **74** which may extend laterally aftwardly from an upper portion of the handle assembly **32**. The perch **72** is preferably mounted on the perch post **74** at a height which is suitable for straddling or mounting by the operator **16** such that the rider's knees are slightly bent. Optionally, the perch **72** may be configured to be height-adjustable to suit operators **16** of different height. Furthermore, the perch **72** is preferably adapted to be pivotally connected to the handle assembly **32** such that the perch post **74** may be folded generally parallel to the handle assembly **32**. When folded the perch post **74** minimizes the total volume occupied by the scooter **10** to facilitate shipping and storage of the scooter **10**.

To facilitate pivoting of the perch post **74**, the scooter **10** may further include a slotted brace **76** having a slot with a detent at one end thereof and which is configured to engage a pin mounted to the support assembly **24**, as shown in FIG. **2**. In this manner, upward pivoting of the perch post **74** is facilitated by first disengaging the detent from the pin such that the pin may slide through the slot as the perch post **74** is pivoted upwardly.

Referring briefly to FIG. **7**, in a further embodiment of the scooter **10**, the chassis **18** is shown having an articulated joint **30** interposed between the support assembly **24** and handle assembly **32** at a forward lower end of the chassis **18**. The articulated joint **30** is configured to torsionally couple the horizontally oriented support assembly **24** with the vertically oriented handle assembly **32**. In this regard, the articulated joint **30** is configured to allow for lateral rolling motion of the support assembly **24** in a direction opposite that of the handle assembly **32**.

The articulated joint **30** provides a means by which the operator **16** may propel the bicycle skateboard by laterally rolling the foot support **26** (i.e., due to asymmetric loading thereof) out-of-phase with the handle assembly **32**. Propulsive force may thereby be generated which then translates into forward motion of the scooter **10**. The articulated joint **30** may further include a biasing means such as a coil spring **50** and/or dampening means in order to bias the support assembly **24** and handle assembly **32** into neutral alignment and which facilitates the out-of-phase motion of the support assembly **24** relative to the handle assembly **32**. Such an arrangement also provides a self-steering characteristic to the scooter **10** as well as a self-standing feature during periods of non-use of the scooter **10**. The biasing means further provides rolling resistance to the support assembly **24** relative to the handle assembly **32** and thereby stabilize the scooter **10** at low speeds.

Referring still to FIG. **7**, the perch **72** may be supported in an alternative arrangement wherein the perch post **74** extends vertically upwardly from the foot support **26** in order to allow for seated operation of the scooter **10**. A pair of braces **76** may extend upwardly from the foot support **26** to increase the load-carrying capability of the perch post **74** under the weight of the operator **16'** seated on the perch **72**. The foot support **26** is preferably configured to provide sufficient area for placement of the operator's feet when seated on the perch **72**.

Referring briefly to FIG. **2**, the scooter **10** may optionally include a motor **82** drivingly coupled to at least one of the front and rear wheels **44**, **56**. The motor **82** is configured to impart rotational motion to the front and/or rear wheels **44**, **56** in order to propel the scooter **10**. The motor **82** may be configured as an electric motor **82** and may be operatively coupled to the rear wheels **56** such as by means of a motor shaft connected to the rear axle **60**. Power for the motor **82** may be provided by means of a power source **84** such as a battery which, in conjunction with the motor **82**, may be mounted below the foot support **26** such as that shown in FIG. **2**. Preferably, the motor **82** and/or power source **84** are mounted in such a manner so as to provide sufficient ground clearance to accommodate lateral rolling motion of the support assembly **24** during steering of the scooter **10**.

Regulation of the motor **82** may be facilitated through the use of a throttle **40** which may be mounted on the handle assembly **32** as shown in FIGS. **2**, **4**, and **5**. Braking or slowing of the scooter **10** may be facilitated through the use of a brake mechanism such as a disc brake or rim brakes operated via a brake lever **42** also mounted on at least one of opposing lateral arm members **34** as shown in FIGS. **2**, **4** and **5**.

Referring to FIGS. **1-4**, the general configuration of the chassis **18** includes the horizontally-oriented support assembly **24** which forms the support surface upon which the operator **16** may stand and to which the rear wheels **56** are pivotally mounted. In an embodiment shown in FIG. **3**, the foot support **26** may be comprised of an arrangement of structural elements such as tubular members which are configured to provide sufficient surface area for supporting both of the rider's feet.

Regarding the geometric relationship of the various components of the scooter **10**, the front wheel **44** is preferably a pneumatic wheel of relatively large diameter (e.g., 12 inch-28 inch) and preferably having a tire tread of a width generally less than about 2 inches although wider tires are contemplated. The cross sectional geometry of the tire tread itself is preferably radiused to facilitate lateral rolling motion of the front wheel **44**. The diameter of the front wheel **44** is preferably between about 6-10 times the diameter of the rear wheels **56**. The rear wheels **56** each preferably have a width generally equal to the diameter of the rear wheels **56** although various other width/diameter ratios are contemplated. The rear wheels **56** also preferably have a generally flat or planar tread surface in order to maximize lateral traction during turning.

As was indicated earlier, steering of the scooter **10** is facilitated by angular yawing of the rear wheels **56** in response to asymmetric loading or weighting of the support assembly **24** by the operator **16**. By exerting uneven loading on the foot support **26**, lateral rolling motion of the support assembly **24** and handle assembly **32** to which the front wheel **44** is connected results in angular yawing or turning of the rear wheels **56**. The greater the amount of lateral rolling of the chassis **18** or support assembly **24**, the greater the angular yawing movement at the rear wheels **56** which results in a relatively tighter turning radius of the scooter **10**.

Because the collective area of the contact patch of the rear wheels **56** are greater than the contact patch at the front wheel **44**, steering of the scooter **10** is achieved primarily as a result of angular yawing or turning displacement of the rear wheels **56** in relation to the longitudinal axis A. Traction of the rear wheels **56** may be maximized by optimizing the degree of compliancy of the rear wheels **56** relative to the amount of lateral roll of the support assembly **24**. In this manner, the rear wheels **56** can remain in contact with the ground during steering of the scooter **10** regardless of the yaw angle of the rear wheels **56**.

The scooter **10** may further be provided with additional accessories or features. For example, as shown in FIGS. **1** and **2**, a fender **80** may be included for preventing contact of the operator **16** with the front wheel **44**. As can be seen, the fender **80** may be mounted to the down tubes **22** of the handle assembly **32**. Likewise, small fenders **80** may be provided over each of the rear wheels **56** in order to prevent inadvertent contact with the rider's foot. Wheelie bars may optionally be included with the scooter **10** whereby the wheelie bars may be extended aftwardly from the rear of the support assembly **24** in order to prevent over-rotation or flipping of the scooter **10**, as shown in FIG. **2**C. Foot pegs may optionally be disposed at or below the front axle of the front wheel **44**. Likewise, floorboards, baskets, bags and/or training wheels may further be included with the scooter **10**. In addition, lighting fixtures such as forward headlights and aft tail lights may be included

with the scooter **10** as a safety feature or to enable operation during reduced visibility conditions.

In operation, the scooter **10** may be propelled in a forward direction by a variety of different modes including the operator **16** simply pushing in an aftward direction such as with the operator's foot. As was earlier described, the scooter **10** may further be propelled in a forward direction by laterally rolling the front wheel **44** out-of-phase with lateral rolling of the support assembly **24**. Energy generated during such out-of-phase motion facilitates forward propulsion of the scooter **10**. Forward propulsion of the scooter **10** may further be provided by an electric motor **82** imparting rotational motion to at least one of the front and/or rear wheels **44**, **56**. Regulation of the motor **82** may be facilitated by a throttle **40** which may be mounted to the handle assembly **32** as shown in FIG. **5**. Slowing or stopping of the scooter **10** may be facilitated by a brake mechanism which may be regulated via a brake lever **42** which may be mounted on the handle assembly **32** as shown in FIG. **5**.

The above description is given by way of example and not limitation. Given the above disclosure, one skilled in the art could devise variations that are within the scope and spirit of the invention disclosed herein. Furthermore, the various features of the embodiments disclosed herein can be used alone or in varying combinations with each other and are not intended to be limited to the specific combinations described herein. Thus, the scope of the claims is not to be limited by the illustrated embodiments.

What is claimed is:

1. A three-wheeled scooter for a rider standing in an upright position, the scooter having forward and aft portions, comprising;

a foot support for supporting the rider standing in the upright position, the foot support defining a longitudinal axis;

a front wheel non-pivotally disposed at the forward portion with the front wheel bifurcating the foot support so that the left and right feet of the rider can straddle the front wheel while the rider is in the standing position;

a handle assembly disposed at the forward portion and above the front wheel, the handle assembly being graspable by the hands of the rider; and

a pair of rear wheels disposed at the aft portion and being yawable relative to the longitudinal axis between a neutral position and a yawed position;

wherein:

steering of the scooter is effectuated by angular yawing of the rear wheels relative to the longitudinal axis.

2. The scooter of claim **1** wherein the handle assembly is rigidly connected to the foot support such that lateral rolling of the handle assembly generally with respect to the longitudinal axis facilitates yawing of the rear wheels.

3. The scooter of claim **1** further including:

a trunnion comprising a rear axle and a pivot shaft attached to the rear axle, the pivot shaft pivotally interconnecting the rear axle to the foot support, the pivot shaft being coaxially aligned to the pivot axis;

wherein:

the rear wheels are mounted on opposing ends of the rear axle;

the pivot shaft being oriented such that pivoting of the rear axle thereabout causes yawing of the rear wheels relative to the longitudinal axis

wherein the front wheel diameter is about six to ten times the rear wheel diameter.

4. The scooter of claim **1** further including a motor drivingly coupled to at least one of the front and rear wheels and being configured to impart rotational motion thereto for propelling the scooter.

5. The scooter of claim **1** further comprising a wheelie bar disposed at the aft portion of the foot support and extended aftwardly for preventing flipping of the scooter.

6. The scooter of claim **1** further comprising a fender disposed over an aft portion of the front wheel.

7. A three-wheeled scooter with rear wheel steering, the scooter comprising:

feet support for supporting a rider in the upright position on the three-wheeled scooter, the feet support rollable about a central axis generally extending from a forward portion of the feet support to an aft portion of the feet support;

a front wheel non-pivotally disposed within a slot formed in the forward portion of the feet support so that the left and right feet of the rider can straddle the front wheel while riding the scooter;

a handlebar disposed over the front wheel;

two rear wheels; and

a rear axle with the rear wheels rotatably mounted thereto, the rear axle yawable about a fixed pivot axis for steering the scooter, the fixed pivot axis being skewed with respect to the central axis for yawing the rear axle and steering the scooter to the left when the foot support is rolled to the left and steering the scooter to the right when the foot support is rolled to the right;

wherein the front wheel has a diameter approximately six to ten times larger than a diameter of the rear wheel.

8. The scooter of claim **7** wherein the handlebar allows the rider to steady the three-wheeled scooter.

9. The scooter of claim **7** further comprising a fender disposed over an aft portion of the front wheel.

10. A three-wheeled scooter with rear wheel steering, the scooter comprising:

a foot support for supporting a rider in the upright position on the three-wheeled scooter, the foot support rollable about a central axis generally extending from a forward portion of the foot support to an aft portion of the foot support;

a front wheel non-pivotally disposed within a slot formed in the foot support so that the rider can straddle the front wheel in the upright position, a rotational axis of the front wheel being at an elevation higher than the foot support;

a handle bar disposed over the front wheel;

two rear wheels disposed at the aft portion of the foot support and pivotable so as to move the aft portion of the foot support to the right to steer the scooter to the left or to the left to steer the scooter to the right.

11. The scooter of claim **10** wherein the front wheel rotational axis is at a higher elevation compared to the rear wheel rotational axis.

12. The scooter of claim **10** wherein the front wheel diameter is between six to ten times the rear wheel diameter.

13. The scooter of claim **10** wherein a contact patch of the rear wheels is collectively greater than a contact patch of the front wheel.

14. The scooter of claim **10** further comprising a rear axle with the rear wheels rotatably mounted thereto, the rear axle yawable about a fixed pivot axis to the aft portion of the foot support for steering the scooter, the fixed pivot axis being skewed with respect to the central axis for yawing the rear axle and steering the scooter to the left when the support assembly is rolled to the left and steering the scooter to the right when the foot support is rolled to the right.

15. The scooter of claim **10** wherein the two rear wheels are coaxially mounted to the axle while traversed from a neutral position to a yawed position relative to the central axis for rear wheel steering of the scooter.

16. The scooter of claim **10** further comprising a fender disposed over an aft portion of the front wheel.

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