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(54) **Suspension system for inline skates**

Blattfederung für Sportgerät mit Laufrollen

Suspension par ressort à lame pour un patin en ligne

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Description

Field of the Invention

[0001] The present invention generally relates to a suspension system for inline skates, and more specifically, to a suspension system that incorporates a flexible beam to absorb shock and thereby increase the comfort to those skating over rough terrain.

Background of the Invention

[0002] Inline skating has become a popular pastime, providing both a relaxing outdoor activity and exercise. Compared to earlier skates having two axles on which pairs of opposed wheels were mounted, inline skates used today are much more comfortable and safe. The wheels of inline skates are designed for outdoor usage and readily roll over surfaces that are not very smooth or free of debris. Early skates either had no suspension system, or at best, a very primitive suspension system. Modem inline skates employ wheels made of an elastomeric material that helps to absorb shock, but is not sufficient to absorb the shock of rough terrain, where sidewalk expansion strips, frost heaved sections, and pebbles can produce rather significant shocks to the skater's feet.

[0003] DE-A-198 31652 discloses an inline skate with a more sophistically suspension system.

[0004] To help absorb such shock and enhance the performance and comfort of inline skates, certain inline skates have been designed with more sophisticated suspension systems. Prior suspension systems have included coil springs, elastomeric blocks, leaf springs, and hydraulic pistons. While such suspension systems can indeed enhance the performance of inline skates, they tend to interfere with the control exercised by the skater, don't provide sufficient shock absorption, or are too complex and expensive. Prior art suspension systems that include springs primarily permit vertical deflection of the wheels and are not readily tuned to accommodate skaters of differing weight. Furthermore, it would be desirable to employ a suspension system that allows for other modes of deflection other than in the vertical plane. From a manufacturing and cost consideration, it would be desirable to develop an effective suspension system for inline skates that is relatively simple, contains few parts, and is easy to manufacture. From the viewpoint of the user of inline skates, such inline skates should also be durable and should not interfere with the skating experience. Preferably, the suspension system should improve the comfort *and the control* of the skater, particularly while cornering. In addition, the suspension system should enable the skater to accelerate with greater force by unleashing stored energy as the skater pushes off from a mark.

Summary of the Invention

[0005] According to a first aspect of the invention provides a suspension system for an inline skate having a boot that receives a user's foot, said suspension system comprising:

(a) a mounting bracket having a surface adapted to support a sole of the boot and two opposite sides comprising longitudinally extending supports that depend downwardly from said surface, laterally spaced apart on opposite sides of a longitudinal centerline of said mounting bracket;
(b) characterized by including a first flex beam that is of a single integral configuration and is fixedly attached adjacent to a lower edge of one of the supports and a second flex beam that is of a single integral configuration and is fixedly attached adjacent to a lower edge of the other support, laterally spaced apart from the first flex beam, each flex beam having two opposite ends, the ends of the first flex beam being longitudinally spaced apart from the ends of the second flex beam; and
(c) a plurality of wheels, said wheels being rotatably mounted on axles, in line, generally disposed between facing sides of the first flex beam and the second flex beam, each axle being connected to one end of the first flex beam and the second flex beam, such that a different wheel is resiliently independently supported by each end of the first and the second flex beams, the first and second flex beams deflecting and thereby absorbing shock when the wheels supported by the first and second flex beams roll over a bump, so that the wheels move vertically, independently of each other.

[0006] The present invention provides a simple, yet effective suspension system that reduces the discomfort caused by inline skating over an uneven or rough surface. Additionally, the resiliency of the suspension system provides better control when cornering and aids the skater in pushing off and accelerating. As the skater exerts a downward force on the skate to move forward, the suspension system is deflected in response to the force of the skater's effort. When the skater releases the downward pressure, the suspension system returns the stored energy by providing additional thrust to move the skater forward, as the suspension system returns to its undeflected position.

[0007] In one preferred form of the invention, the flex beam is fabricated from a metal having predefined elastomeric properties. It is also preferable to taper the flex beam, so that it is thinner at each end to achieve a specified deflection for a defined force. The flex beam is also preferably removably coupled to the bracket using a fastener.

[0008] The ends of the flex beam deflect vertically and also may deflect laterally to absorb the shock of a wheel rolling over a bump. In addition, the flex beam deflects about its longitudinal axis when absorbing shock.

[0009] Each side of the bracket may include a front edge and a rear edge that are angled towards each other along the bottom of the bracket. The angled edges provide clearance for deflection of the wheels. In addition, the flex beam includes a tab at each end in which an orifice adapted to accept an axle for supporting a wheel is provided.

[0010] A further aspect of the present invention is directed to a method for reducing shock and vibration transmitted to a skater when a wheel of an inline skate rolls over a bump. The method includes steps that are generally consistent with the elements of the system described above.

Brief Description of the Drawing Figures

[0011] The foregoing aspects and many of the attendant advantages of this invention will become more readily appreciated as the same becomes better understood by reference to the following detailed description, when taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 is an isometric view of a preferred embodiment of the suspension system in accord with the present invention, shown in relation to an inline skate boot (depicted in phantom view);

FIGURE 2 is a partially exploded isometric view of the preferred embodiment of FIGURE 1;

FIGURE 3 is a fully exploded isometric view illustrating more details of the suspension system of the embodiment of FIGURES 1 and 2;

FIGURE 4 is a side elevational view of the suspension system and wheels, in relation to a boot shown in phantom view;

FIGURE 5 is a bottom plan view of the suspension system and wheels;

FIGURE 6 is a left side elevational view of the suspension system and a boot (depicted in phantom view), illustrating the vertical deflection of a skate wheel and its associated flex beam;

FIGURE 7 is a front elevational view of the suspension system, showing a front wheel and its associated flex beam in an undeflected position, and

FIGURE 8 is a front elevational view of the suspension system, showing a wheel and its associated flex beam deflected vertically, and rotationally about a longitudinal axis of the flex beam.

Description of the Preferred Embodiment

[0012] FIGURES 1 through 5 illustrate a preferred embodiment of the present invention. The following discussion includes the terms left, right, front, rear and forward, which are consistent with the terms a person wearing the inline skate boot as in FIGURE 1 would use to describe the inline skate and its orientation. Thus, "left" refers to the side to the left of the skater, "right" refers to the side to the right of the skater, "front" refers to the end of the skate leading in the direction in which the skater normally travels "forward" (as indicated by the large arrow in the drawings), and "rear" refers to the opposite end or direction.

[0013] In FIGURE 1, the disposition of the suspension system is shown relative to a typical inline skate boot 10. A top surface 11 of a mounting bracket 12 includes orifices 13 that accept fasteners (not shown) for use in securing the mounting bracket to the sole of boot 10. The type of fastener used to affix boot 10 to mounting bracket 12 is not a critical feature of the present invention. In the preferred embodiment, the fasteners employed will likely permanently affix boot 10 to mounting bracket 12. Rivets, adhesive, molded constructs, or other permanent fastening means may be used for this purpose. It is also envisioned that removable fasteners such as screws, threaded bolts, or pins and clips can be used to connect boot 10 to mounting bracket 12. Use of removable fasteners for connecting boot 10 and mounting bracket 12 would allow either component to be replaced if desired.

[0014] Mounting bracket 12 is generally elongate, and when viewed from either end, appears to have an inverted "U" shape. The downwardly depending sides of the mounting bracket include a left side 15L, as shown in FIGURE 1, and a right side 15R, as shown in FIGURE 4. When viewed from the side as in FIGURE 4, sides 15L and 15R are not congruent, but instead, may be described as being "complementarily asymmetrical," since each side is designed to support different pairs of wheels 16a/16c, and 16b/16d, respectively.

[0015] Extending outwardly from the lower edge of side 15L is a beam bracket 25L. A similar beam bracket 25R extends outwardly from the lower edge of side 15R, as shown in FIGURE 5. Beam bracket 25L is connected to a flex beam 14L, as shown in FIGURES 1-3, and beam bracket 25R is similarly connected to a flex beam 14R, using threaded fasteners 26, which extend through orifices 22 (shown in FIGURES 2-3) in the beam brackets and are threaded into threaded orifices 24 formed in the flex beams. Alternatively, other types of fasteners, including removable or permanent fasteners, such as rivets (not shown), can be readily used to couple the beam brackets to the flex beams, as will be appreciated by one of ordinary skill in the art.

[0016] Referring once more to FIGURE 1, it will be noted that flex beam 14L comprises two tapered areas 18 in which the thickness of the flex beam changes (flex beam 14R includes identically tapered areas, as will be apparent in FIGURE 3). Flex beam 14L is thickest in its center, where the flex beam is attached to beam bracket 25L. Moving both to the front and to the rear from the center of flex beam 14L, the thickness of flex beam 14L is gradually reduced along the length of tapered areas 18. Tapered areas 18 control the resiliency or flexure of flex beams 14L and 14R. Preferably, the flex beams are fabricated from a heat-treated stainless steel, but it is also contemplated that they may be made of fiber reinforced plastic or other suitable materials having the required strength and elasticity. The thickness of the flex beams and the degree of the taper in tapered areas 18 are selected to provide a desired amount of resiliency to the suspension system so that the flex beams deflect by a desired amount for a specific force. Tapering the thickness of the flex beams also ensures that more of the deflection of the flex beams occurs closer to the ends of the flex beams rather than at the center where the flex beams are attached to beam brackets 25L and 25R, respectively.

[0017] While flex beams 14L and 14R include tapered areas 18 in this preferred embodiment, it is envisioned that flex beams without tapered areas can alternatively be used. The suspension characteristics (the "softness" or "firmness" of the suspension) can be controlled by varying either the thickness of the flex beams or the degree and longitudinal extent of tapered areas 18. It is also contemplated that the flex beams may be configured to have an arcuate shape (i.e., with a concave side of the arcuate shaped flex beams facing downwardly) to provide yet another parameter for controlling the resiliency of the suspension system. It is also contemplated that inline skates will be provided with suspension systems that are appropriate for use by skaters of differing weight and skill level. A heavier skater will likely prefer a suspension system that is stiffer and deflects less for a given force than a lighter weight skater. In addition, a skater who is more experienced may also prefer a suspension system that is stiffer.

[0018] Adjacent to the thinnest section of each tapered area 18, flex beams 14L and 14R include tabs 20, which extend downwardly from the horizontal surface of the flex beams. A particularly important feature of the preferred embodiment of the invention is the manner in which tabs 20 of flex beams 14L and 14R are connected to the plurality of wheels 16a-16d of the inline skate. In the preferred embodiment, the inline skate has four wheels 16a-16d, arranged sequentially in a line from the front to the rear of the mounting bracket, as clearly shown in FIGURES 1-4 and FIGURE 6. Each wheel is connected to one tab 20 of either flex beam 14R or flex beam 14L. Furthermore, as shown in FIGURE 3, wheels 16a/16c are attached to tabs 20 at opposite ends of flex beam 14L and wheels 16b/16d are attached to tabs 20 at opposite ends of flex beam 14R.

[0019] FIGURE 2 shows the preferred embodiment of the inline skate suspension system seen from the same orientation as FIGURE 1, but with boot 10 removed and mounting bracket 12 spaced apart from the flex beams, so that both flex beam 14L and flex beam 14R can be seen. From this view, it can be clearly seen that each wheel is attached to a different tab 20 of either flex beam 14R or 14L, such that adjacent wheels are not connected to the same flex beam.

[0020] While not shown, it is envisioned that mounting bracket 12 and flex beams 14L and 14R may be formed as an integral unit instead of as separate pieces. Such an integral unit would preferably comprise a high impact fiber reinforced polymer, formed by injection molding or other suitable process. The fiber reinforcement should ensure that the resulting integrally formed flex beams are of sufficient strength and resiliency. The use of such an integral structure is expected to reduce manufacturing costs as well as simplifying the production/assembly process.

[0021] FIGURE 3 clearly shows how mounting bracket 12, flex beams 14L and 14R, and wheels 16a 16d are connected to tabs 20, at the ends of flex beams 14L and 14R. Axles 30 pass through tabs 20, then through ball or needle bearings 32, which are disposed within the center of wheels 16a-16d and are held in place by axle retainers 34. The specific bearings 32 employed is not a critical feature of this invention, since it is contemplated that conventional high quality inline skate wheel and bearing assemblies will be used. Those of ordinary skill in the art will readily understand that a wide variety of wheel bearings and other types of axle assemblies may be connected to tabs 20.

[0022] In the preferred embodiment, axles 30 are fabricated of stainless steel. Axle retainers 34 are threaded into the mating threaded orifices provided in each end of axles 30 and can be removed to facilitate maintenance or replacement of wheels 16a-16d and bearings 32. While not preferred, it is contemplated that axles 30 may be welded to tabs 20. Also, axle retainers 34 may be permanently fastened to axles 30, precluding removal of the wheels from the axles. While permanent connection of the wheel assemblies to flex beams 14L and 14R would not allow for the replacement of the above-described components, this option would likely reduce manufacturing costs. However, it is preferable to employ axles 30 and axle retainers 34 of the type and style used in conventional inline skates, since it is likely that experienced skaters will prefer to be able to replace these components when worn, with off-the-shelf replacements. Those of ordinary skill in the art will readily understand that a variety of different axles 30 and axle retainers 34 may be beneficially employed in the present invention.

[0023] FIGURE 4 is a side elevation view of the right-hand side of the preferred embodiment of a roller skate in accord with the present invention. From this perspective, it can clearly be seen that wheels 16a-16b are connected to tabs 20 of flex beam 14 in such a fashion that alternating wheels are connected to different flex beams 14L or 14R. It also can clearly be seen that wheel 16b is connected to front tab 20 of right-hand side flex beam 14R. Similarly wheel 16d is connected to rear tab 20 of right-hand side flex beam 14R.

[0024] The perspective of FIGURE 4 also illustrates additional details of mounting bracket 12. Note that an edge 12a of side 15R on mounting bracket 12 is angled away from wheel 16d sufficiently to provide substantial clearance when wheel 16d deflects under load. Similarly, an edge 12d of side 15L on mounting bracket 12 is also angled to provide sufficient clearance for wheel 16a when it is deflected under load. Angled surfaces 12b and 12c (the latter being hidden from view and shown as a dashed line) reduce the mass and weight of mounting bracket 12, and also provide clearance for the deflection of wheel 16b and 16c, respectively. A web 35 (shown in dashed lines in this Figure because it is hidden from view) connects sides 15L and 15R, providing lateral support the sides and generally strengthening the mounting bracket. FIGURE 5 shows web 35 more clearly.

[0025] FIGURE 6 illustrates how flex beams 14L and 14R allow for the vertical deflection of wheels 16a-16d to absorb shocks as the wheels roll over a surface 36. In this view, wheel 16a is illustrated passing over a bump 38 on surface 36. Forward tab 20 and forward tapered area 18 of flex beam 14L support wheel 16a, and are deflected upwardly a distance 40, to allow wheel 16a to roll over bump 38. Because wheels 16a-16d are independently suspended, the end of the flex beams supporting each wheel will successively deflect upwardly as that wheel rolls over bump 38. Because of the shock absorbing deflection that occurs as each wheel encounters bump 38, the skater is NOT subjected to the series of sharp jarring sensations experienced by a skater using conventional inline skates that do not include a suspension system. Instead, the present invention absorbs the shocks of expansion strips, uneven surfaces, pebbles, and other irregular surface features due to the deflections of the flex beams that support the wheels on each skate.

[0026] FIGURES 7 and 8 are to be treated as views of the present invention from a head-on perspective that illustrates another of its features. This view illustrates wheel 16a traveling first over a smooth surface (FIGURE 7), and then over an irregular surface (FIGURE 8) that causes deflection of the forward end of flex beam 14L as wheel 16a, the front wheel, rolls over bump 38.

[0027] In FIGURE 7, wheel 16a is shown with the end of the flex beam deflected only minimally, as would be the case when the wheel is rolling over a level surface 36. FIGURE 8 shows how the present invention allows for both vertical deflection of wheel 16a, as well as a deflection of wheel 16a about a longitudinal axis of flex beam 14L, when the wheel encounters bump 38. This bump causes flex beam 14L and wheel 16a to deflect upwardly through a vertical distance 40 and to deflect laterally through a distance 42, as the wheel deflects around the longitudinal axis of flex beam 14L through an angle 44. The lateral and angular deflections of flex beam 14L and wheel 16a are somewhat exaggerated, to better illustrate the deflections. While not shown, it should be understood that wheels 16b-16d also deflect through a similar range of motion when the flex beam to which they are attached absorbs the shock as the wheels successively roll over bump 38. It has been found that this slight lateral and angular deflection aids control by the skater for much the same reason that a slight camber of automobile wheels is desirable to facilitate steering control of an automobile. When cornering or riding over bumps, it has been found that the suspension system in accord with the present invention enables the skater to remain in control and to enjoy a level of comfort that has generally not been noted in conventional inline skates without a suspension system.

[0028] Although the present invention has been described in connection with the preferred form of practicing it, those of ordinary skill in the art will understand that many modifications can be made thereto within the scope of the claims that follow. Accordingly, it is not intended that the scope of the invention in any way be limited by the above description, but instead be determined entirely by reference to the claims that follow.

Claims

1. A suspension system for an inline skate having a boot (10) that receives a user's foot, said suspension system comprising:

(a) a mounting bracket (12) having a surface (11) adapted to support a sole of the boot (10) and two opposite sides comprising longitudinally extending supports (15L, 15R) that depend downwardly from said surface, laterally spaced apart on opposite sides of a longitudinal centerline of said mounting bracket (12);

(b) **characterized by** including a first flex beam (14L) that is of a single integral configuration and is fixedly attached adjacent to a lower edge of one of the supports (15L) and a second flex beam (14R) that is of a single integral configuration and is fixedly attached adjacent to a lower edge of the other support (15R), laterally spaced apart from the first flex beam (14L), each flex beam having two opposite ends, the ends of the first flex beam being longitudinally spaced apart from the ends of the second flex beam; and

(c) a plurality of wheels (16a-16b), said wheels being rotatably mounted on axles, in line, generally disposed between facing sides of the first flex beam (14L) and the second flex beam (14R), each axle being connected to one end of the first flex beam and the second flex beam, such that a different wheel is resiliently independently supported by each end of the first and the second flex beams (14L, 14R), the first and second flex beams (14L, 14R) deflecting and thereby absorbing shock when the wheels supported by the first and second flex beams roll over a bump, so that the wheels (16a-16d) move vertically, independently of each other.

2. The suspension system of Claim 1, wherein said mounting bracket (12) has an inverted "U" shape defined by the surface and sides of the mounting bracket, a mount for said first flex beam (14L) on one support being longitudinally offset from a mount for said second flex beam (14R) on the other support.

3. The suspension system of Claim 1, wherein said mounting bracket (12) and said first and second flex beams (14L, 14R) are formed as an integral unit.

4. The suspension system of Claim 1, wherein said first and second flex beams (14L, 14R) are fabricated from a metal.

5. The suspension system of Claim 1, wherein said first and second flex beams (14L, 14R) are fabricated from a plastic.

6. The suspension- system of Claim 1, wherein a first and a third wheel (16a-16c) are supported by the first flex beam (14L), and a second and a fourth wheel (16b-16d) are supported by the second flex beam (14R).

7. The suspension system of Claim 1, further comprising a bearing (32) for rotatably mounting a wheel (16a-16d) on each axle.

8. The suspension system of Claim 1, wherein wheels are mounted on axles that extend laterally from the facing sides of said first and second flex beams.

9. The system of Claim 1, wherein said first and second flex beams (14L, 14R) deflect around a longitudinal axis of the first and second flex beams, respectively, when the wheels (16a-16d) supported thereby roll over a bump.

10. The system of Claim 1, wherein the ends of said first and second flex beams (14L, 14R) are tapered in thickness to provide a desired degree of deflection.

11. A method for reducing shock and vibration transmitted to a skater when a wheel of an inline skate (10) rolls over a bump, comprising the steps of:

(a) attaching a supporting structure (12) to a sole of the inline skate (10);
(b) providing a plurality of flex beams (14L, 14R), each flex beam being of a single integral configuration, extending along a longitudinal axis and having opposite ends;
(c) fixedly mounting said plurality of flex beams (14L, 14R) at different positions, so that a position at which each flex beam is mounted is laterally and longitudinally offset from a position at which a successive flex beam is mounted along said supporting structure; and
(d) mounting a plurality of wheels (16a-16d) to the ends of the flex beams (14L, 14R) on axles that are each supported by only one end of the flex beams, so that a different wheel is attached to an axle at each end of each of said plurality of flex beams, at longitudinally spaced apart locations, and adjacent wheels are not connected to the same flex beam, said flex beams deflecting to absorb the shock when the wheels roll over a bump.

12. The method of Claim 11, further comprising the step of providing clearance between the supporting structure (12) and the plurality of wheels (16a-16d) to enable the deflection of the ends of the plurality of flex beams and the plurality of wheels supported thereby.

13. The method of Claim 11, wherein the plurality of flex beams (14L, 14R) deflect both vertically and horizontally, enabling the each of the plurality of wheels to move vertically independently of each other as the plurality of wheels roll over a bump.

14. The method of Claim 11, wherein the longitudinal axes of said plurality of flex beams (14L, 14R) extend generally parallel to a direction along which said wheels (16a-16d) are rolling.

15. The method of Claim 11, wherein the supporting structure (12) and the plurality of flex beam (14L, 14R) are formed as an integral unit.

16. The method of Claim 13, wherein each of the plurality of flex beams (14L, 14R) deflects around its longitudinal axis when a wheel supported by the flex beam rolls over a bump.

17. The method of Claim 13, further comprising the step of tapering a thickness of the plurality of flex beams adjacent to each end to achieve a desired degree of deflection in response to a deflecting (14L, 14R) force.

Revendications

1. Système de suspension pour un patin en ligne comportant une bottine (10) qui reçoit le pied d'un utilisateur, ledit système de suspension comprenant :

(a) un support de fixation (12) présentant une surface (11) adaptée pour supporter une semelle de la bottine (10) et deux côtés opposés comprenant des supports (15L, 15R) s'étendant de manière longitudinale qui dépendent de manière descendante à partir de ladite surface, espacés latéralement sur des côtés opposés d'une ligne centrale longitudinale dudit support de fixation (12) ;
(b) **caractérisé en ce qu'**il comprend une pre-

mière plaque de flexion (14L) qui présente une configuration intégrale unique et qui est fixement attachée de manière adjacente à un bord inférieur de l'un des supports (15L) et une seconde plaque de flexion (14R) qui présente une configuration intégrale unique et qui est attachée fixement de manière adjacente à un bord inférieur de l'autre support (15R), espacée latéralement de la première plaque de flexion (14L), chaque plaque de flexion ayant deux extrémités opposées, les extrémités de la première plaque de flexion étant espacées longitudinalement des extrémités de la seconde plaque de flexion ; et
(c) une pluralité de roulettes (16a-16d), lesdites roulettes étant montées de manière rotative sur des axes, en ligne, en général disposés entre des côtés se faisant face de la première plaque de flexion (14L) et de la seconde plaque de flexion (14R), chaque axe étant connecté à une extrémité de la première plaque de flexion et de la seconde plaque de flexion, de sorte qu'une roulette différente est supportée indépendamment de manière élastique par chaque extrémité de la première plaque de flexion et de la seconde plaque de flexion (14L, 14R), les première et seconde plaques de flexion (14L, 14R) fléchissants et par conséquent absorbant le choc lorsque les roulettes supportées par les première et seconde plaques de flexion roulent sur une bosse, de sorte que les roulettes (16a-16d) se déplacent verticalement, indépendamment l'une de l'autre.

2. Système de suspension selon la revendication 1, dans lequel ledit support de fixation (12) a une forme de « U » inversé définie par la surface et les côtés du support de fixation, une monture pour ladite première plaque de flexion (14L) sur un support étant décalée longitudinalement d'une monture pour ladite seconde plaque de flexion (14R) sur l'autre support.

3. Système de suspension selon la revendication 1, dans lequel ledit support de fixation (12) et lesdites première et seconde plaques de flexion (14L, 14R) sont formés en un seul tenant.

4. Système de suspension selon la revendication 1, dans lequel lesdites première et seconde plaques de flexion (14L, 14R) sont fabriquées en métal.

5. Système de suspension selon la revendication 1, dans lequel lesdites première et seconde plaques de flexion (14L, 14R) sont fabriquées en un matériau plastique.

6. Système de suspension selon la revendication 1, dans lequel une première et une troisième roulettes (16a-16c) sont supportées par la première plaque de flexion (14L), et une deuxième et une quatrième roulettes (16b-16d) sont supportées par la seconde plaque de flexion (14R).

7. Système de suspension selon la revendication 1, comprenant en outre un roulement (32) pour monter de manière rotative une roulette (16a-16d) sur chaque axe.

8. Système de suspension selon la revendication 1, dans lequel les roulettes sont montées sur des axes qui s'étendent latéralement à partir des côtés se faisant face desdites première et seconde plaques de flexion.

9. Système selon la revendication 1, dans lequel lesdites première et seconde plaques de flexion (14L, 14R) dévient autour d'un axe longitudinal des première et seconde plaques de flexion, respectivement, lorsque les roulettes (16a-16d) supportées sur celles-ci roulent sur une bosse.

10. Système selon la revendication 1, dans lequel les extrémités desdites première et seconde plaques de flexion (14L, 14R) sont effilées au niveau de leur épaisseur pour fournir un degré souhaité de déviation.

11. Procédé destiné à réduire le choc et la vibration transmis à un patineur lorsqu'une roulette d'un patin en ligne (10) roule sur une bosse, comprenant les étapes de :

(a) fixation d'une structure de support (12) à une semelle du patin en ligne (10) ;
(b) fourniture d'une pluralité de plaques de flexion (14L, 14R), chaque plaque de flexion ayant une configuration intégrale unique, s'étendant le long d'un axe longitudinal et ayant des extrémités opposées ;
(c) montage fixe de ladite pluralité de plaques de flexion (14L, 14R) au niveau de différentes positions, de sorte qu'une position au niveau de laquelle chaque plaque de flexion est montée est décalée latéralement et longitudinalement d'une position au niveau de laquelle une plaque de flexion successive est montée le long de ladite structure de support ; et
(d) montage d'une pluralité de roulettes (16a-16d) au niveau des extrémités des plaques de flexion (14L, 14R) sur des axes qui sont chacun supportés par uniquement une extrémité des plaques de flexion, de sorte qu'une roulette différente est attachée à un axe au niveau de chaque extrémité de chaque plaque de flexion de ladite pluralité de plaques de flexion, au niveau d'emplacements espacés longitudinalement, et les roulettes adjacentes ne sont pas connectées

à la même plaque de flexion, lesdites plaques de flexion fléchissant afin d'absorber le choc lorsque les roulettes roulent sur une bosse.

12. Procédé selon la revendication 11, comprenant en outre l'étape de fourniture d'un jeu entre la structure de support (12) et la pluralité de roulettes (16a-16d) afin de permettre la déviation des extrémités de la pluralité de plaques de flexion et de la pluralité de roulettes supportées sur celles-ci.

13. Procédé selon la revendication 11, dans lequel la pluralité de plaques de flexion (14L, 14R) dévie à la fois verticalement et horizontalement, permettant à chaque roulette de la pluralité de roulettes de se déplacer verticalement indépendamment des autres lorsque la pluralité de roulettes roule sur une bosse.

14. Procédé selon la revendication 11, dans lequel les axes longitudinaux de ladite pluralité de plaques de flexion (14L, 14R) s'étendent en général parallèlement à une direction le long de laquelle lesdites roulettes (16a-16d) roulent.

15. Procédé selon la revendication 11, dans lequel la structure de support (12) et la pluralité de plaques de flexion (14L, 14R) sont formées en un seul tenant.

16. Procédé selon la revendication 13, dans lequel chaque plaque de flexion de ladite pluralité de plaques de flexion (14L, 14R) fléchit autour de son axe longitudinal lorsqu'une roulette supportée par la plaque de flexion roule sur une bosse.

17. Procédé selon la revendication 13, comprenant en outre l'étape d'effilage d'une épaisseur de la pluralité de plaques de flexion adjacente à chaque extrémité pour obtenir un degré souhaité de flexion en réponse à une force de déviation (14L, 14R).

Patentansprüche

1. Ein Aufhängungssystem für ein Inlineskate mit einem Schuh (10), der den Fuß eines Benutzers aufnimmt, wobei das Aufhängungssystem umfaßt:

(a) eine Montageklammer (12) mit einer Oberfläche (11), die angepaßt ist, eine Sohle des Schuhs (10) zu stützen, und zwei gegenüberliegenden Seiten, die zwei sich längs erstreckende Träger (15L, 15R) umfassen, welche an der Oberfläche nach unten gerichtet anhängen und seitlich auf gegenüberliegenden Seiten einer Längsmittellinie der Montageklammer (12) beabstandet sind;
(b) **gekennzeichnet durch** einen ersten enthaltenen Biegebalken (14L), der aus einer einzigen integralen Struktur besteht und angrenzend an eine untere Kante des einen der Träger (15L) fest befestigt ist, und einen zweiten enthaltenen Biegebalken (14R), der aus einer einzigen integralen Struktur besteht und an einer unteren Kante des anderen Trägers (15R) fest befestigt und seitlich von dem ersten Biegebalken (14L) beabstandet ist, wobei jeder Biegebalken zwei gegenüberliegende Enden besitzt und die Enden des ersten Biegebalkens in Längsrichtung von den Enden des zweiten Biegebalkens beabstandet sind; und
(c) eine Mehrzahl von Rädern (16a-16b), wobei die Räder drehbar auf Achsen montiert sind, die allgemein zwischen aufeinander zuweisenden Seiten des ersten Biegebalkens (14L) und des zweiten Biegebalkens (14R) in Reihe angeordnet sind, wobei jede Achse einseitig mit dem ersten Biegebalken und dem zweiten Biegebalken so verbunden ist, daß ein anderes Rad unabhängig federnd **durch** jedes Ende des ersten und des zweiten Balkens (14L, 14R) gehalten wird, wobei die ersten und zweiten Biegebalken (14L, 14R) auslenken und **dadurch** Stöße absorbieren, wenn die **durch** die ersten und zweiten Biegebalken gehaltenen Räder über einen Buckel rollen, so daß die Räder (16a-16d) sich unabhängig voneinander vertikal bewegen.

2. Das Aufhängungssystem nach Anspruch 1, wobei die Montageklammer (12) eine umgekehrte U-Form besitzt, die durch die Oberfläche und Seiten der Montageklammer definiert ist, wobei eine Befestigung für den ersten Biegebalken (14L) an einem Träger zu einer Befestigung für den zweiten Biegebalken (14R) an dem anderen Träger in Längsrichtung versetzt ist.

3. Die Aufhängung nach Anspruch 1, wobei die Montageklammer (12) und der erste und zweite Biegebalken (14L, 14R) als integrale Einheit ausgebildet sind.

4. Das Aufhängungssystem nach Anspruch 1, wobei der erste und zweite Biegebalken (14L, 14R) aus einem Metall gefertigt sind.

5. Das Aufhängungssystem nach Anspruch 1, wobei der erste und zweite Biegebalken (14L, 14R) aus Kunststoff gefertigt sind.

6. Aufhängungssystem nach Anspruch 1, wobei ein erstes und ein drittes Rad (16a-16c) durch den ersten Biegebalken (14L) gehalten werden und ein zweites und ein viertes Rad (16b-16d) durch den zweiten Biegebalken (14R) gehalten werden.

7. Das Aufhängungssystem nach Anspruch 1, desweiteren umfassend ein Lager (32) auf jeder Achse zum drehbaren Befestigen eines Rads (16a-16d).

8. Aufhängungssystem nach Anspruch 1, wobei Räder auf Achsen montiert sind, die sich seitlich von den aufeinander zuweisenden Seiten der ersten und zweiten Biegebalken erstrecken.

9. Das System nach Anspruch 1, wobei der erste und zweite Biegebalken (14L, 14R) um eine Längsachse des ersten bzw. zweiten Biegebalkens auslenken, wenn die **dadurch** gehaltenen Räder (16a-16d) über einen Buckel rollen.

10. Das System nach Anspruch 1, wobei sich die Dicke der Enden der ersten und zweiten Biegebalken (14L, 14R) verjüngen, um einen gewünschten Auslenkungsgrad zu bieten.

11. Ein Verfahren zum Reduzieren von Stößen und Vibration, die auf einen Skater übertragen werden, wenn ein Rad eines Inlineskate (10) über einen Buckel rollt, umfassend die Schritte:

(a) Befestigen einer Stützstruktur (12) an einer Sohle eines Inlineskate (10);
(b) Zur-Verfügung-Stellen einer Mehrzahl von Biegebalken (14L. 14R), wobei jeder Biegebalken aus einer einzigen Integralstruktur besteht, sich entlang einer Längsachse erstreckt und gegenüberliegende Enden besitzt;
(c) festes Befestigen der Mehrzahl von Biegebalken (14L, 14R) an unterschiedlichen Positionen, so daß eine Position, an der jeder Biegebalken montiert ist, seitlich und in Längsrichtung von einer Position versetzt liegt, an der ein nächstfolgender Biegebalken entlang der Stützstruktur montiert ist; und
(d) Montieren einer Mehrzahl von Rädern (16a-16d) an den Enden der Biegebalken (14L, 14R) auf Achsen, die jeweils durch nur ein Ende der Biegebalken gehalten werden, so daß ein anderes Rad auf einer Achse an jedem Ende von jedem der Mehrzahl von Biegebalken an in Längsrichtung beabstandeten Orten befestigt ist, und daß benachbarte Räder nicht mit demselben Biegebalken verbunden sind, wobei die Biegebalken auslenken, um einen Stoß zu absorbieren, wenn das Rad über einen Buckel rollt.

12. Das Verfahren nach Anspruch 11, desweiteren umfassend den Schritt des Zur-Verfügung-Stellens eines freien Abstands zwischen der Stützstruktur (12) und der Mehrzahl von Rädern (16a-16d), um das Auslenken der Enden der Mehrzahl von Biegebalken und der **dadurch** gehaltenen Mehrzahl von Rädern zu ermöglichen.

13. Verfahren nach Anspruch 11, wobei die Mehrzahl von Biegebalken (14L, 14R) sowohl vertikal als auch horizontal auslenken und es jedem der Mehrzahl von Rädern ermöglichen, sich unabhängig voneinander vertikal zu bewegen, wenn die Mehrzahl von Rädern über einen Buckel rollt.

14. Das Verfahren nach Anspruch 11, wobei sich die Längsachsen der Mehrzahl von Biegebalken (14L, 14R) allgemein parallel zu einer Richtung erstrekken, entlang der die Räder (16a-16d) rollen.

15. Verfahren nach Anspruch 11, wobei die Stützstruktur (12) und die Mehrzahl von Biegebalken (14L, 14R) als integrale Einheit ausgebildet werden.

16. Das Verfahren nach Anspruch 13, wobei jeder der Mehrzahl von Biegebalken (14L, 14R) um seine Längsachse auslenkt, wenn ein von dem Biegebalken gehaltenes Rad über einen Buckel rollt.

17. Das Verfahren nach Anspruch 13, desweiteren umfassend den Schritt des Zuspitzens einer Dicke der Mehrzahl von Biegebalken angrenzend an jedes Ende, um einen gewünschten Auslenkungsgrad auf eine Auslenkungskraft (14L, 14R) zu erzielen.

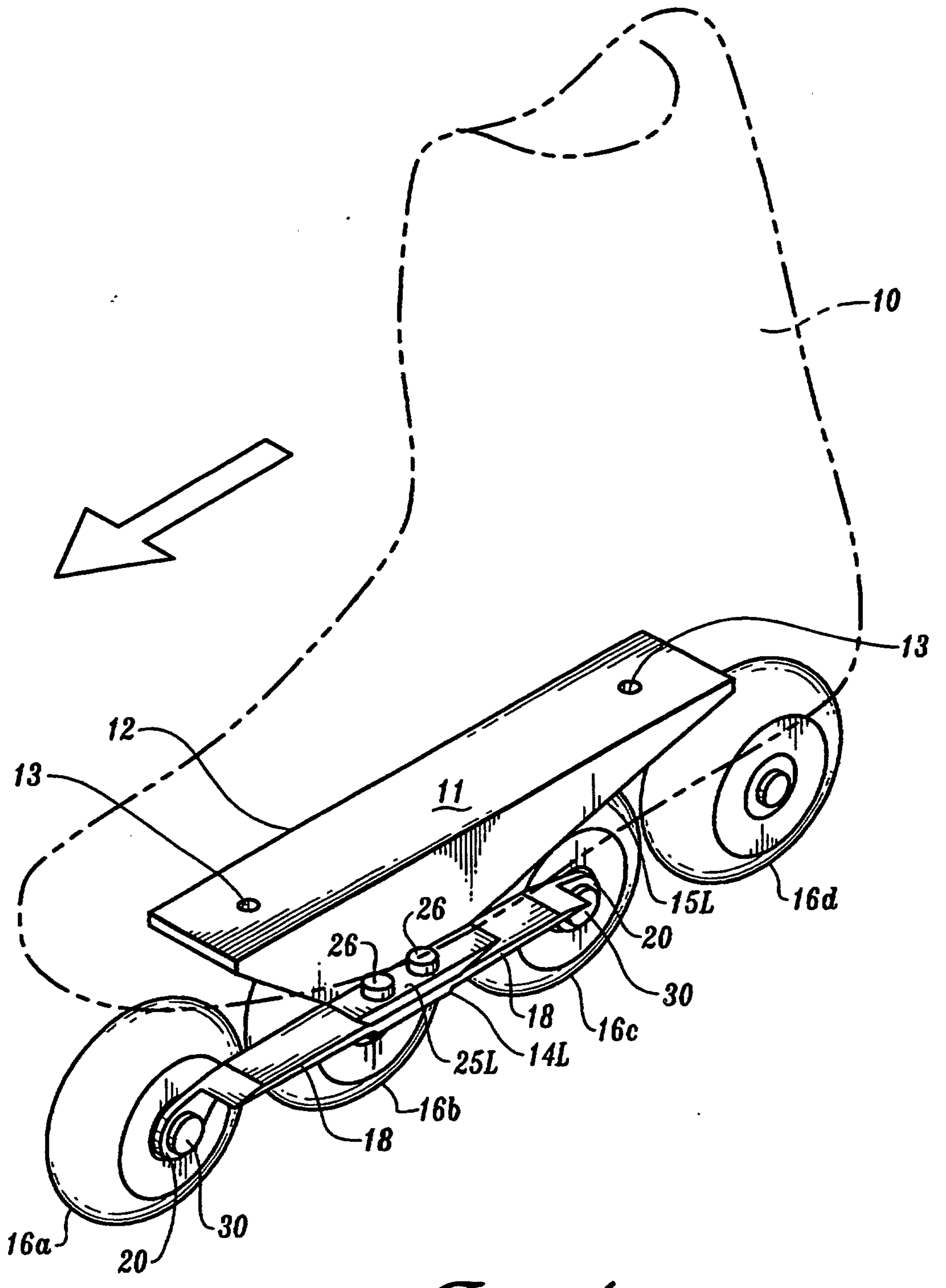
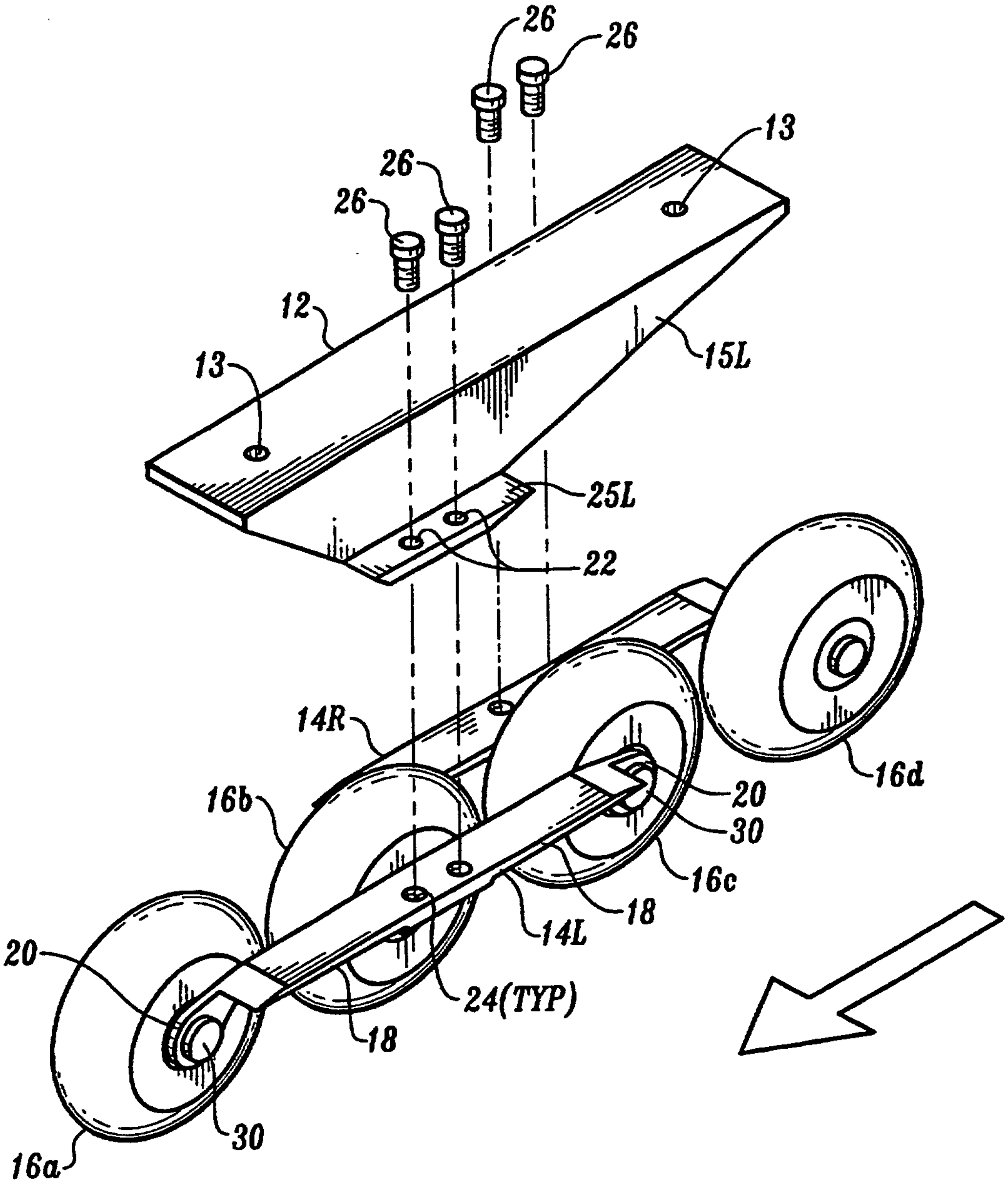


Fig. 1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26
13
26
26
12
13
15L
25L
22
14R
16d
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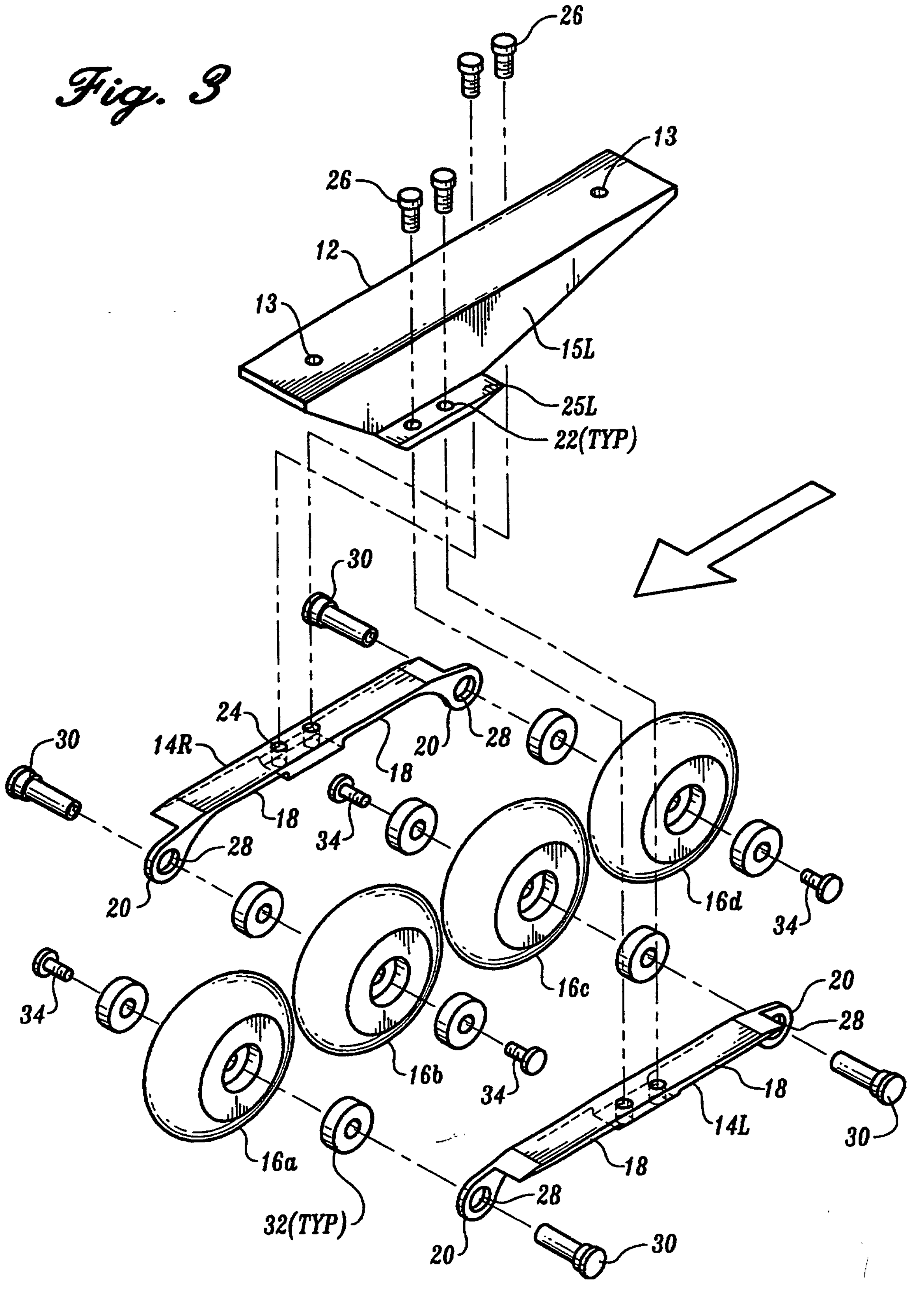
30
16b
16c
18
14L
20
24(TYP)
18
30
16a

Fig. 2

Fig. 3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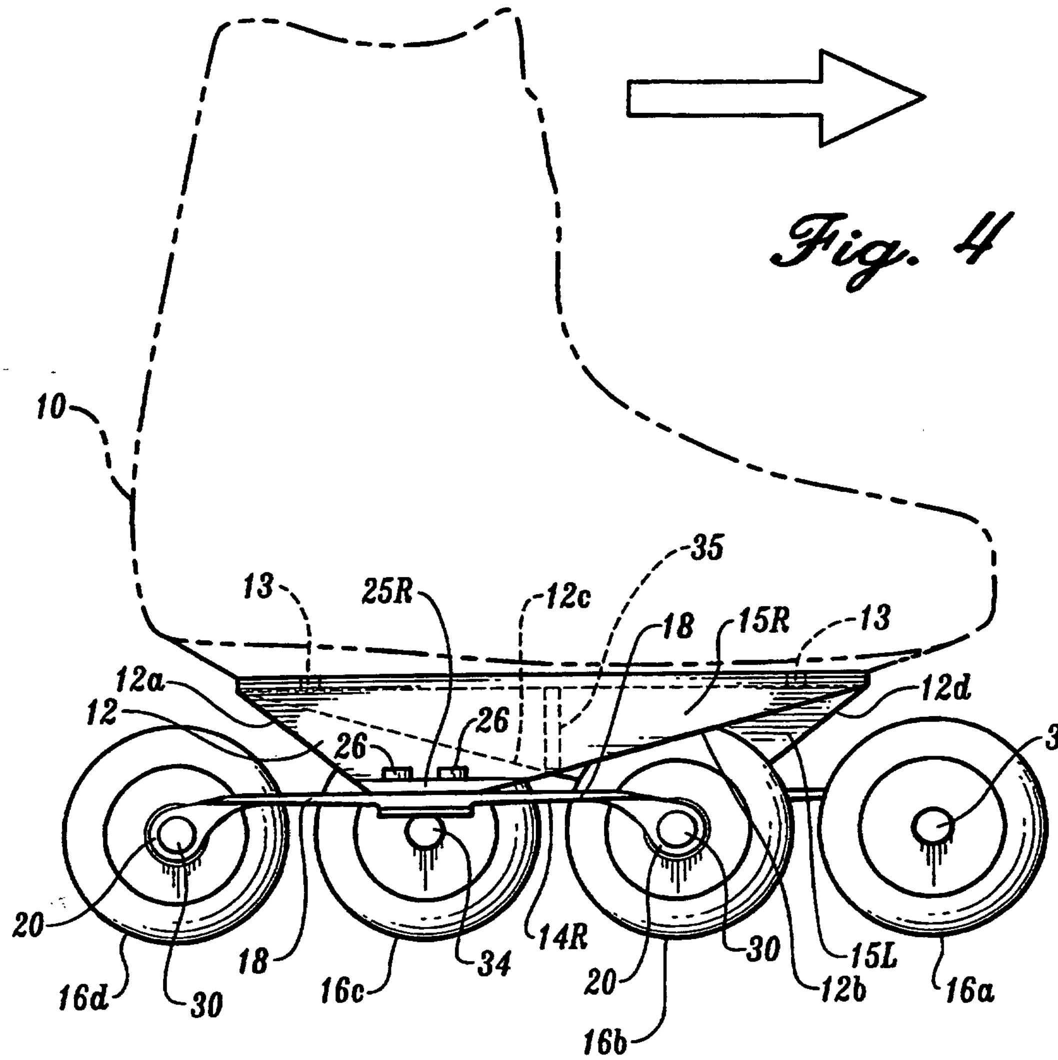
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16d
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16c
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14R
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16b
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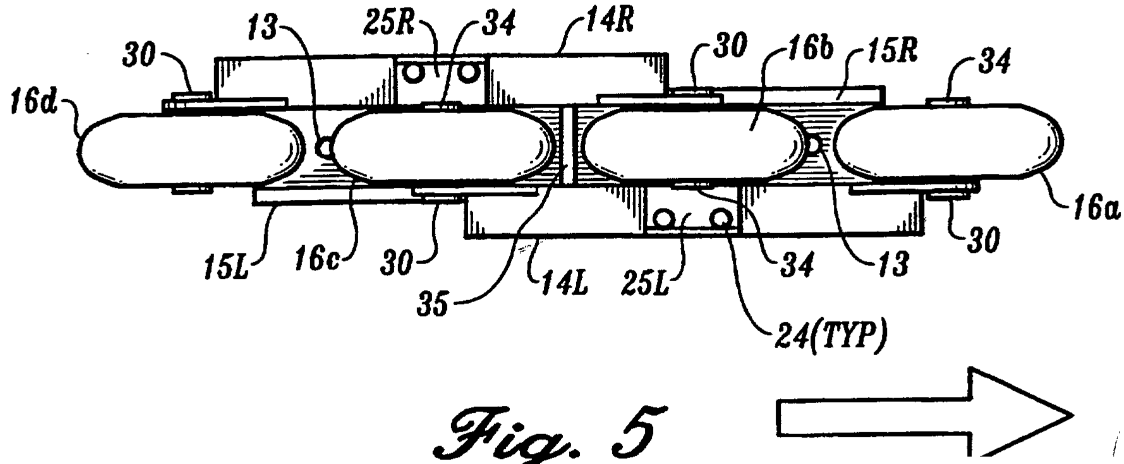
15L
12b
16a

Fig. 4


30
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25R
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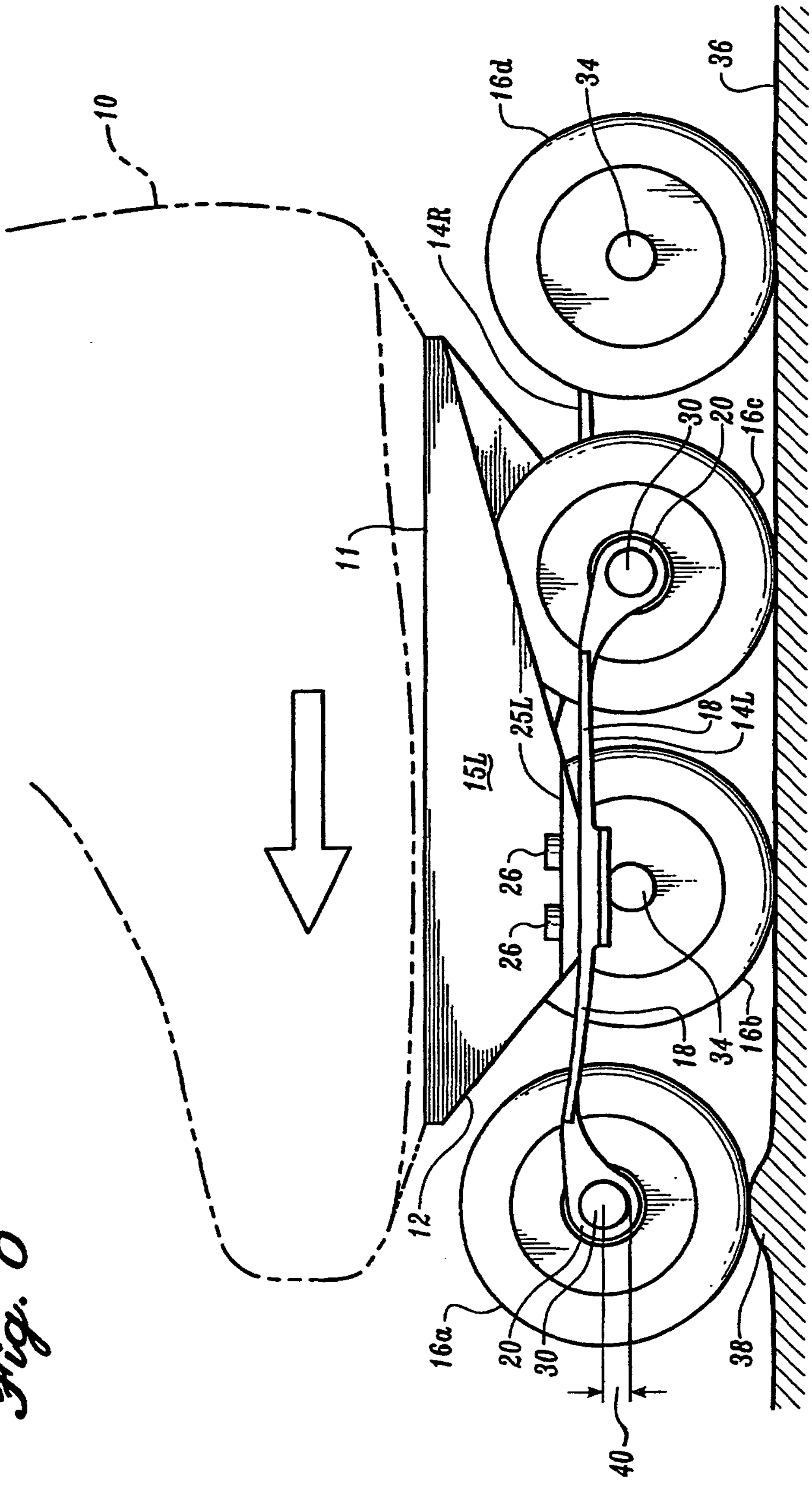
24(TYP)

Fig. 5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15L
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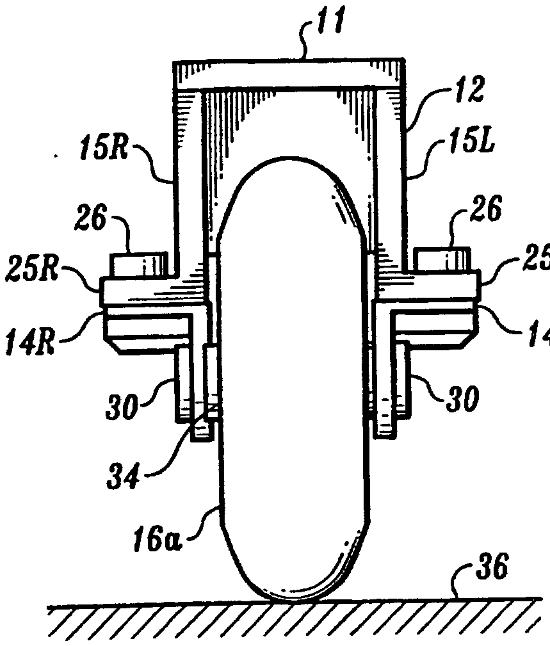
Fig. 6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14R
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16a
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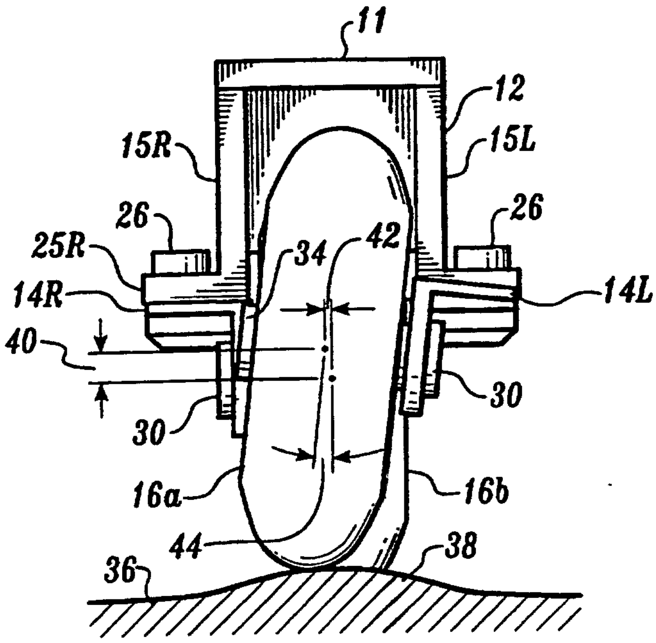
Fig. 7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25R
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42
14R
14L
40
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16a
16b
44
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36

Fig. 8