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(54) **IN-LINE SKATE**

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(57) **ABSTRACT**

An improved in-line skate with novel foot holding, brake, shock-absorption and wheel assemblies. In one aspect of the invention, the brake assembly includes a plurality of brake pads for engaging all of the skate wheels when activated. The brake pads are movable from a disengaged position to

an engaged position when the foot holding assembly is tilted rearwardly by the user. In another aspect of the invention, the rearmost brake pad may be pivoted into engagement with both the ground and the rearmost wheel by lifting a forward portion of one of the skates in a conventional braking motion. Clutch mechanisms are provided for selectively restraining rearward rolling motion of the skate wheels for hill climbing or racing purposes. A shock absorber couples the foot holding assembly to the wheel assembly for improved comfort and performance. The invention also includes an adjustable locking mechanism for releasably locking some or all of the wheels in a fixed position to enable a user to safely walk up stairs, enter stores, or ride on public transit etc. Preferably, a front portion of the skate frame is pivotally or flexibly attached to a rear portion thereof so that a skater can walk with a normal gait when the wheels are locked. The size of the foot holding assembly is readily adjustable to accommodate different users or footwear of different sizes, including conventional street shoes or running shoes. When not in use, the skate is foldable to a compact size for ease of portability or storage. The skate is also designed for optional attachment of ice skate, roller skate or similar accessories.

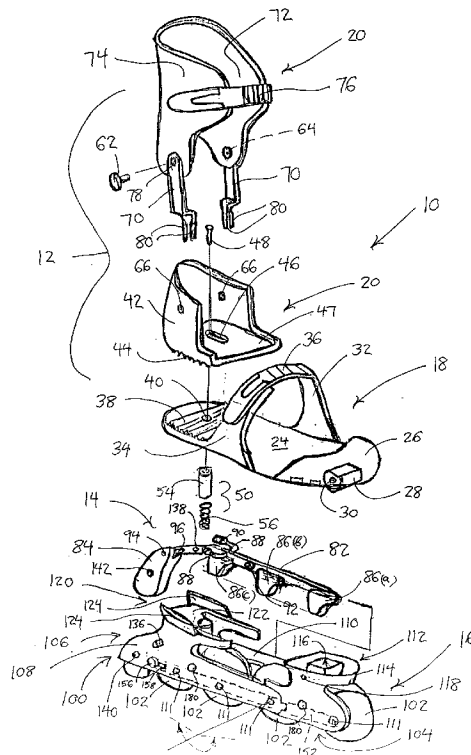


FIGURE 1

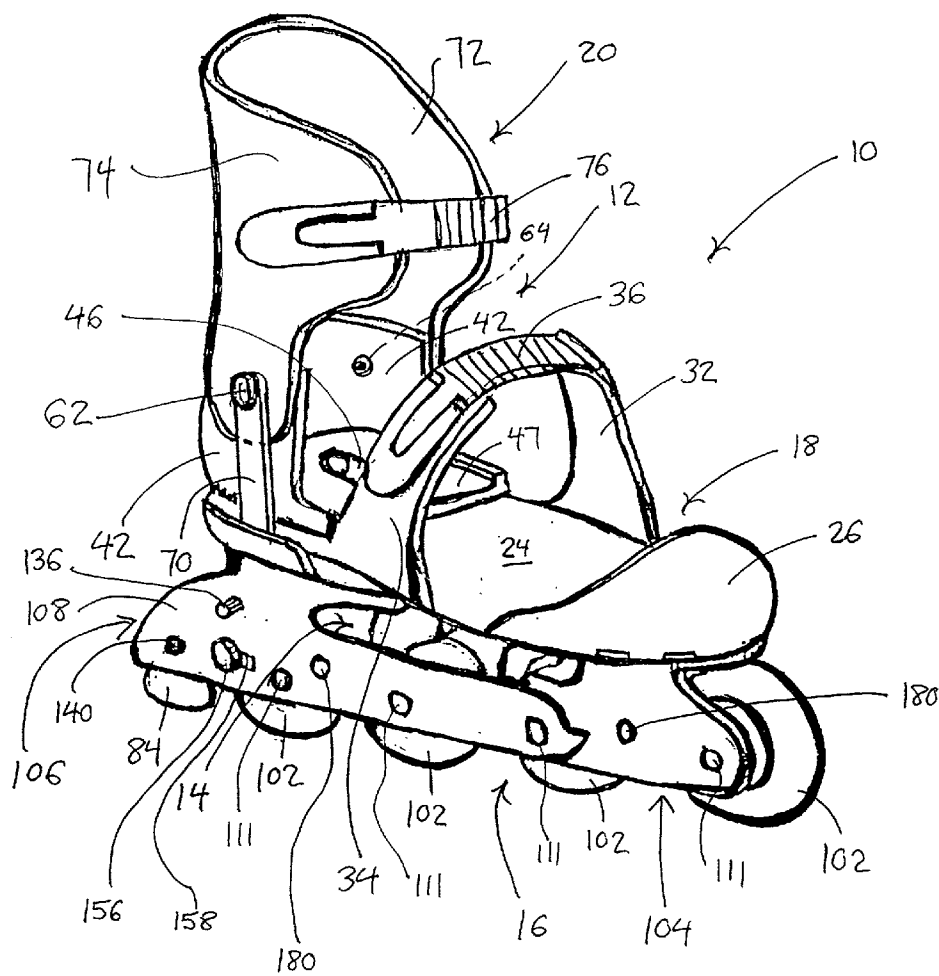


FIGURE 2

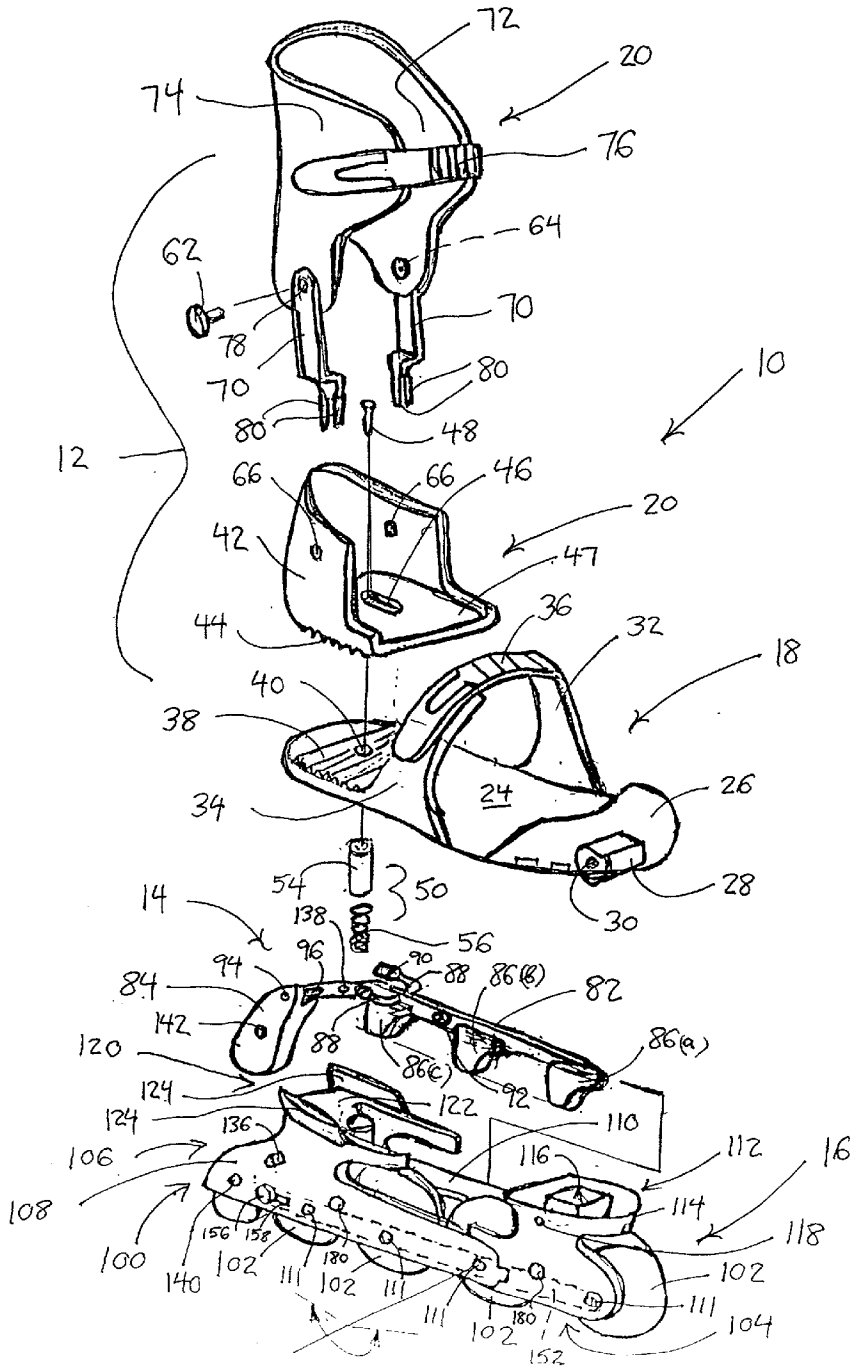


FIGURE 3A

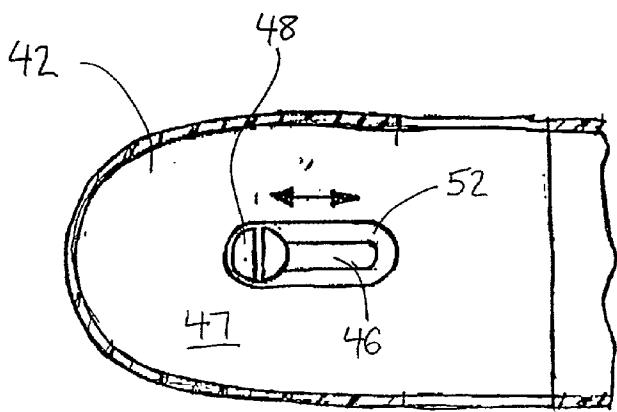


FIGURE 3B

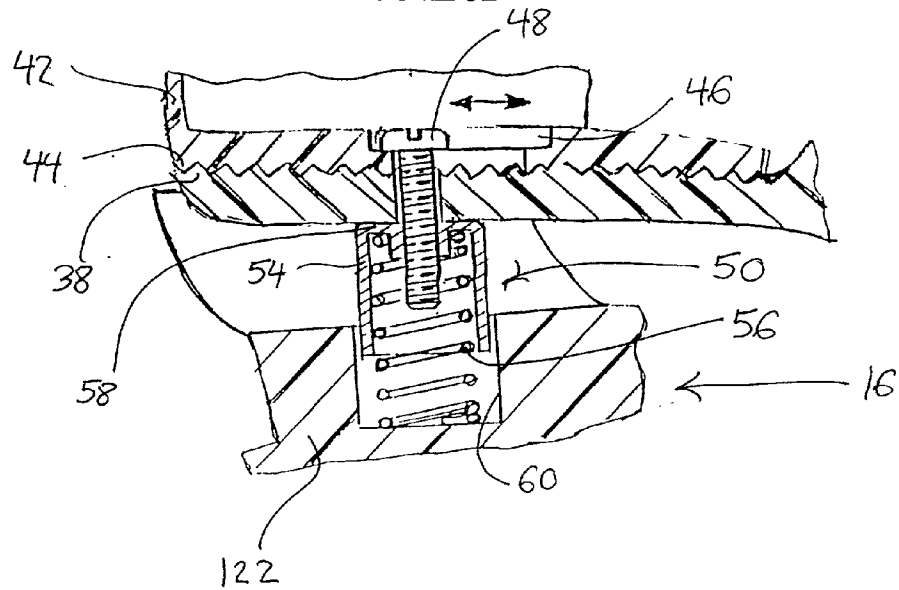
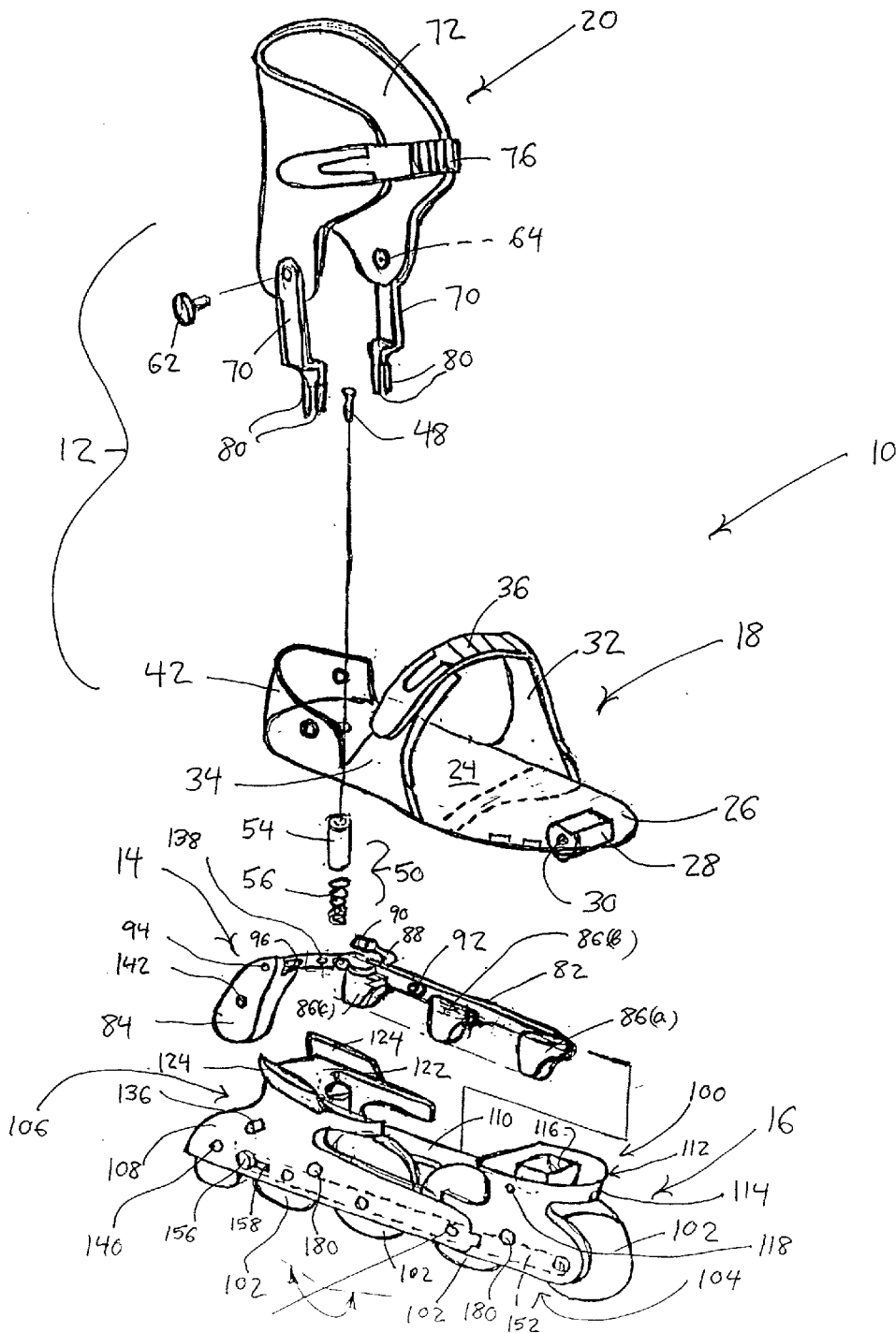


FIGURE 4



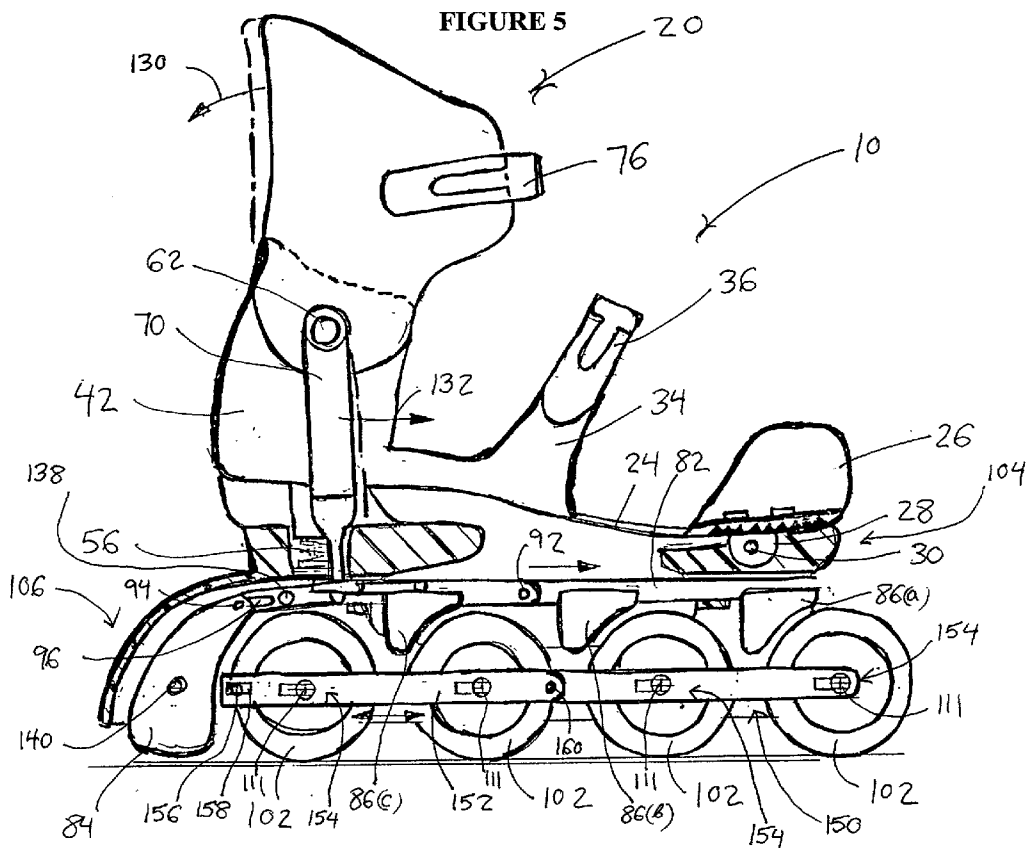


FIGURE 6

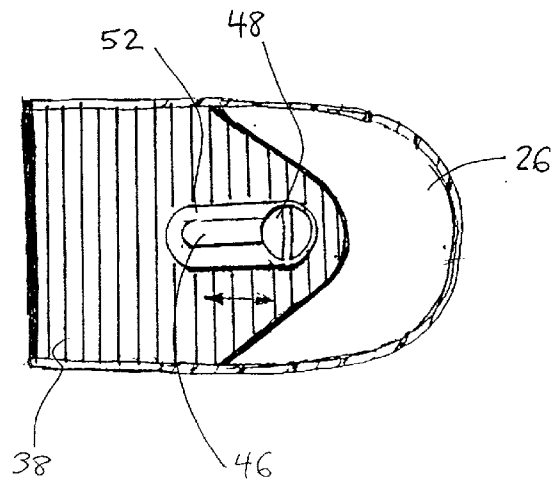
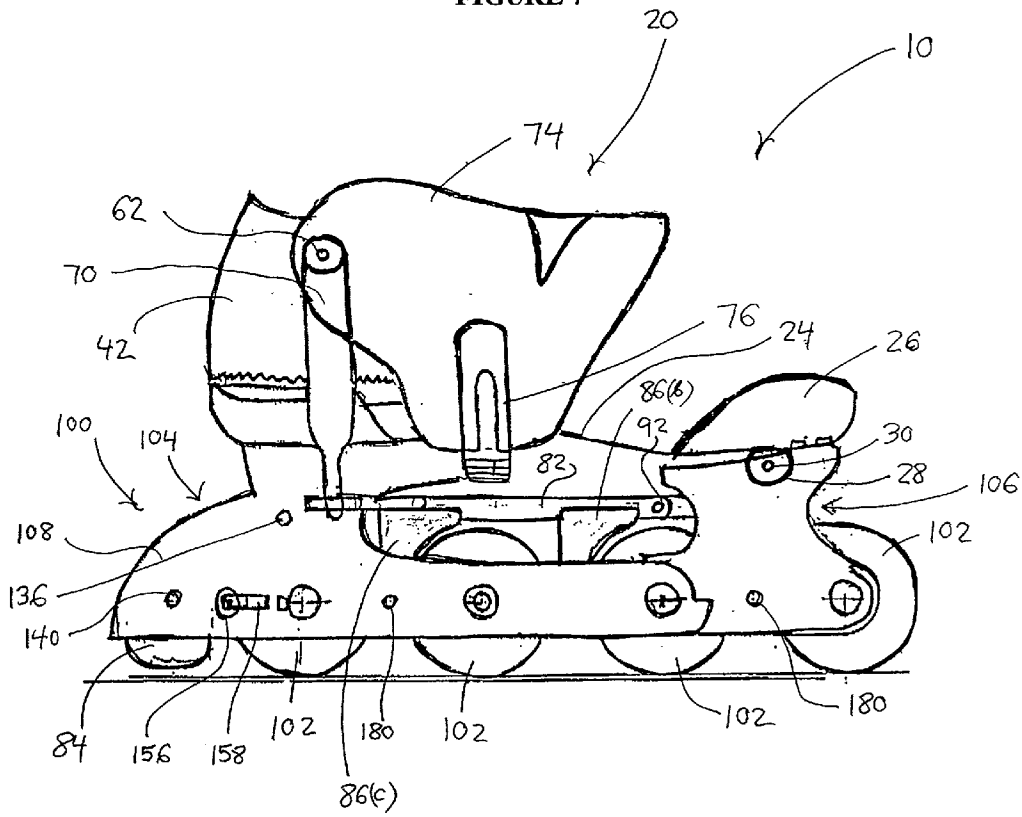


FIGURE 7



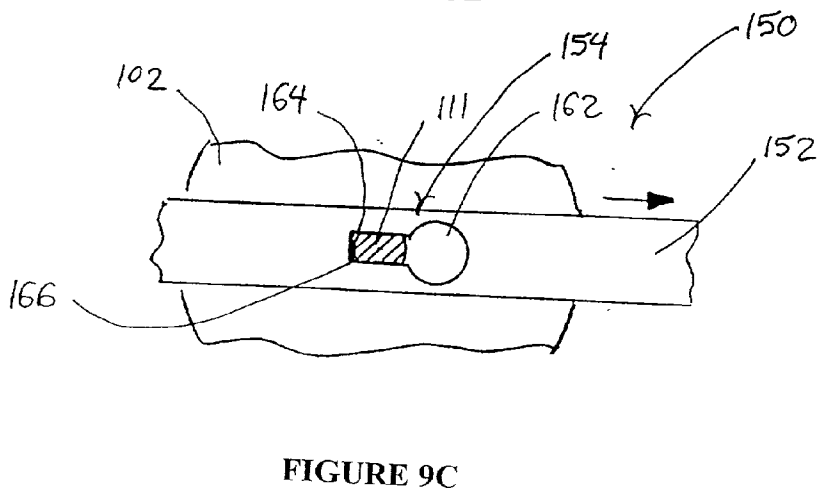
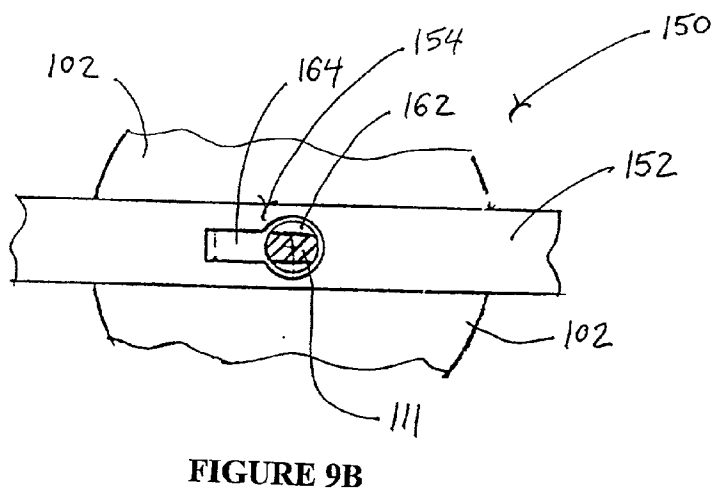
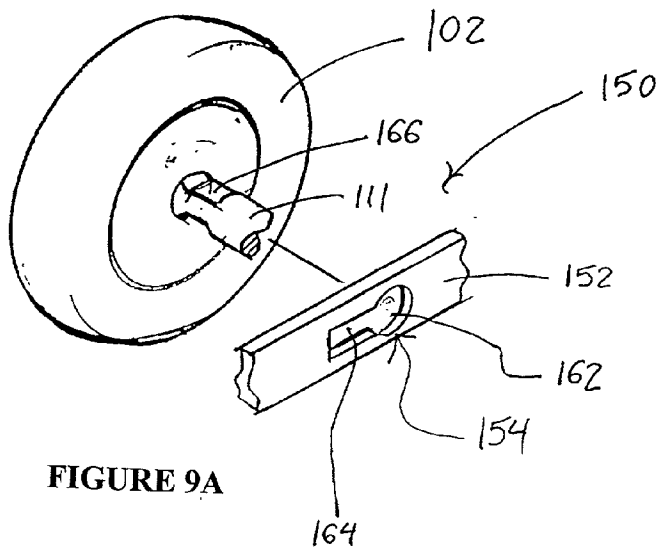
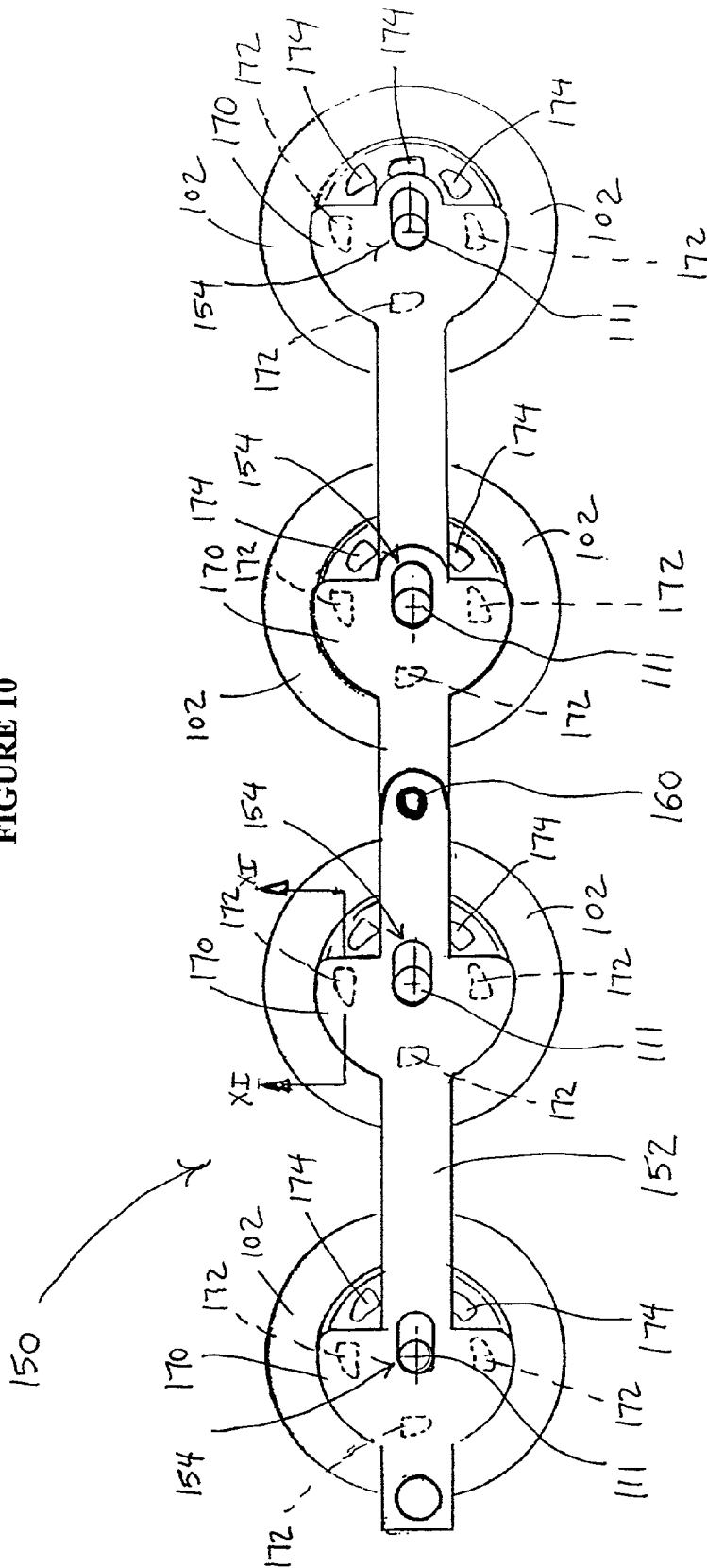


FIGURE 10



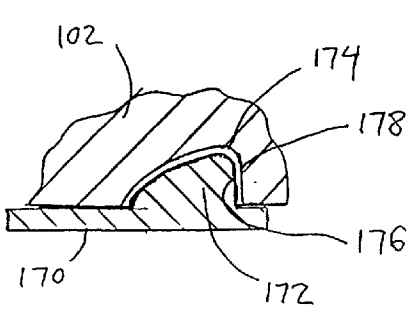


FIGURE 11A

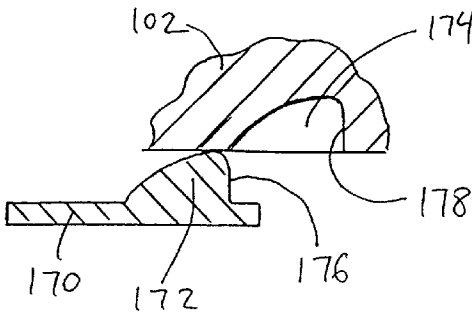


FIGURE 11B

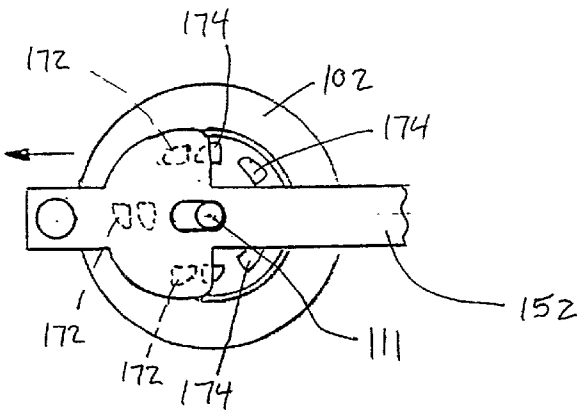


FIGURE 12

FIGURE 13

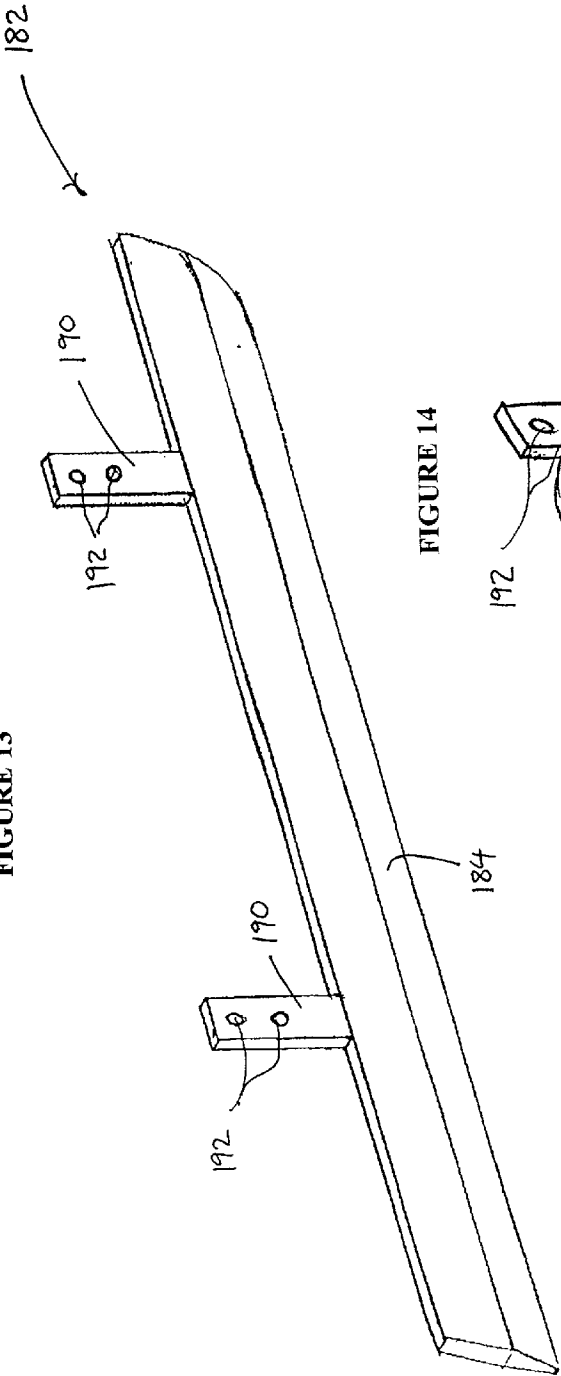


FIGURE 14

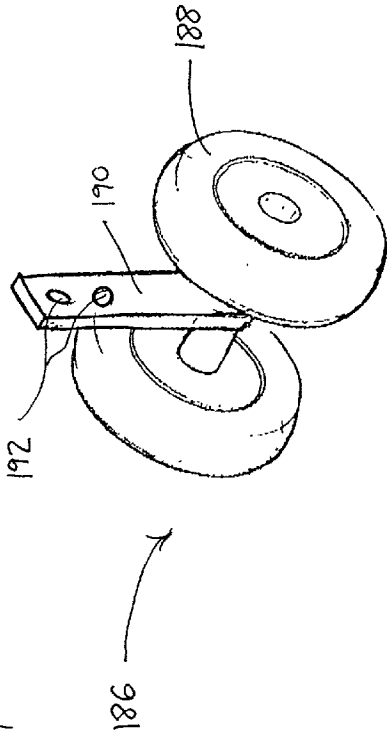


FIGURE 15

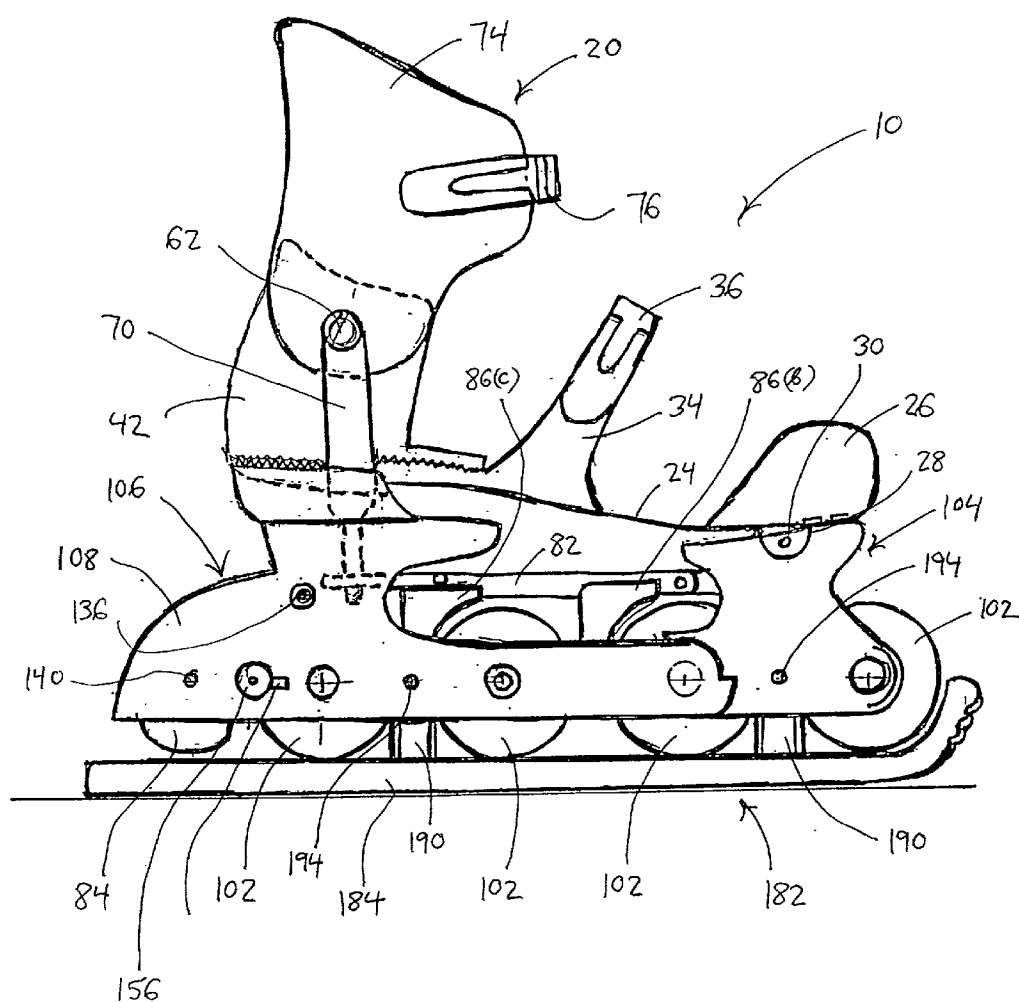


FIGURE16

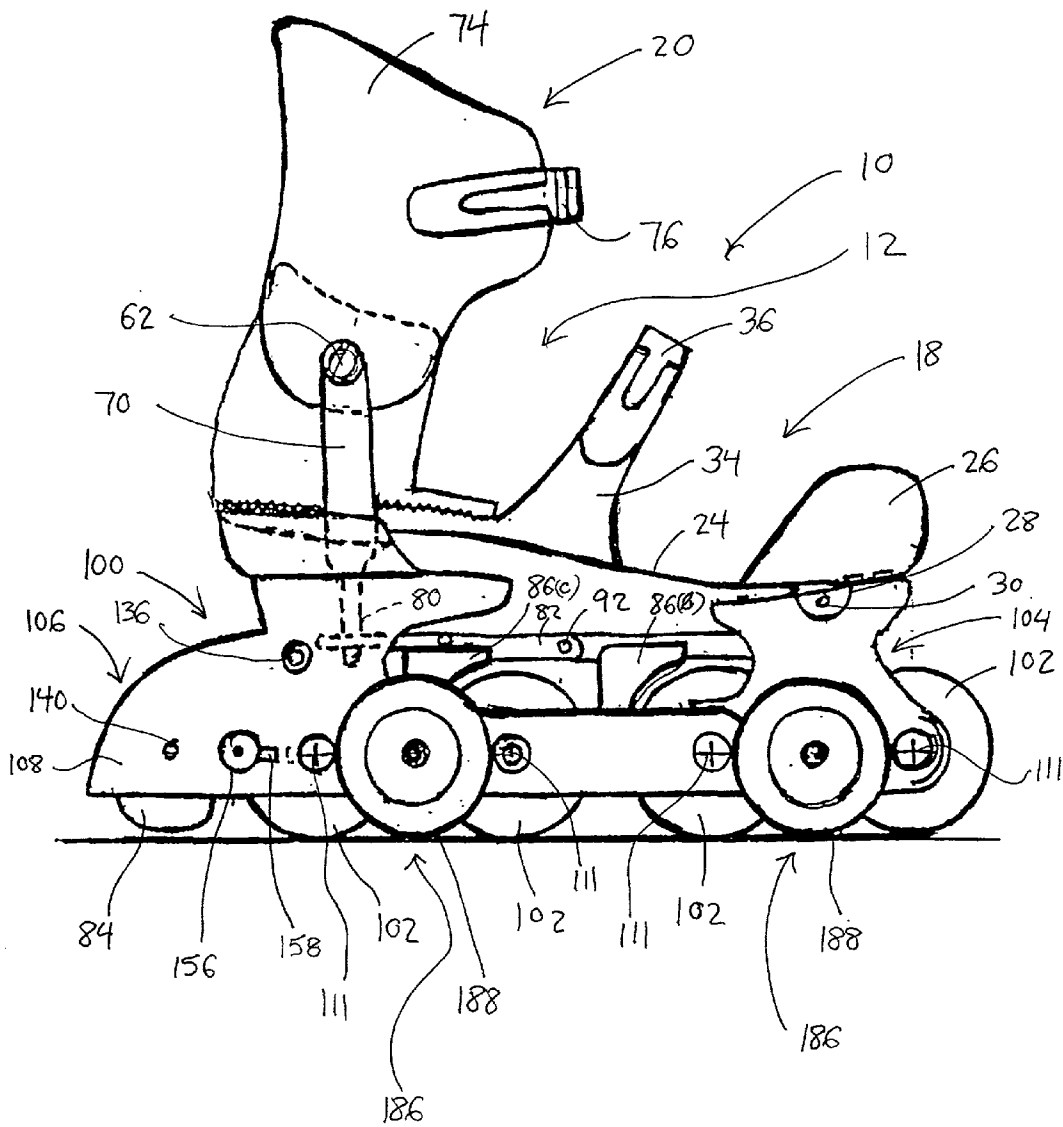


FIGURE 17

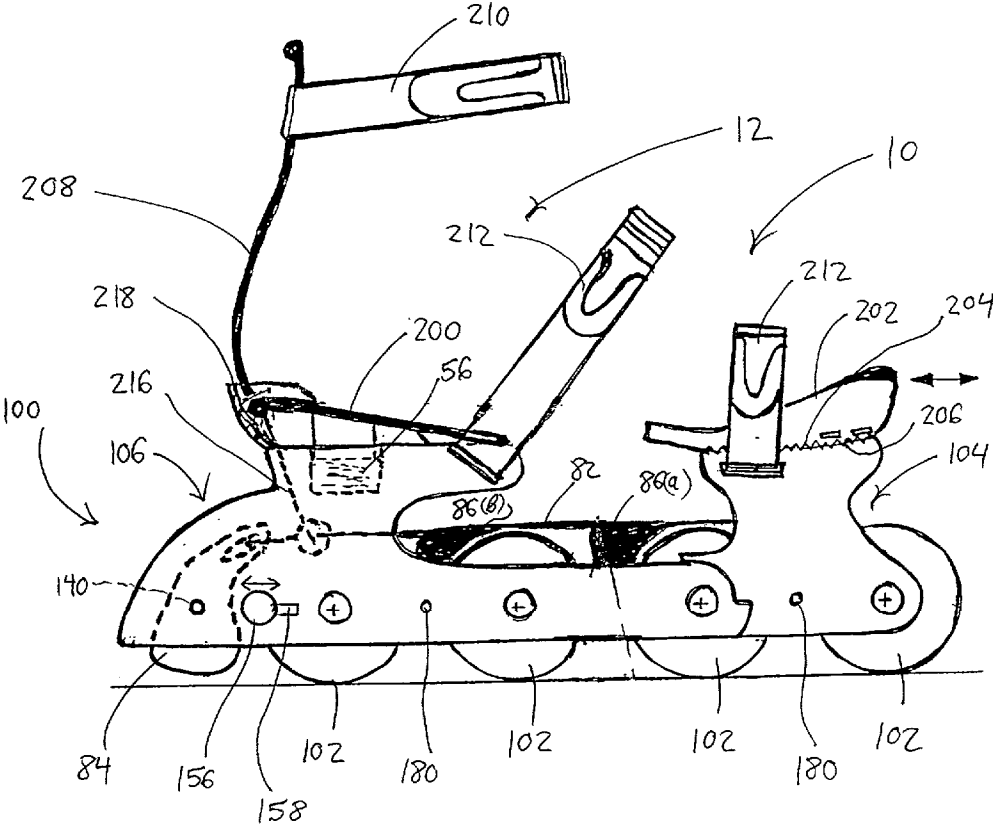
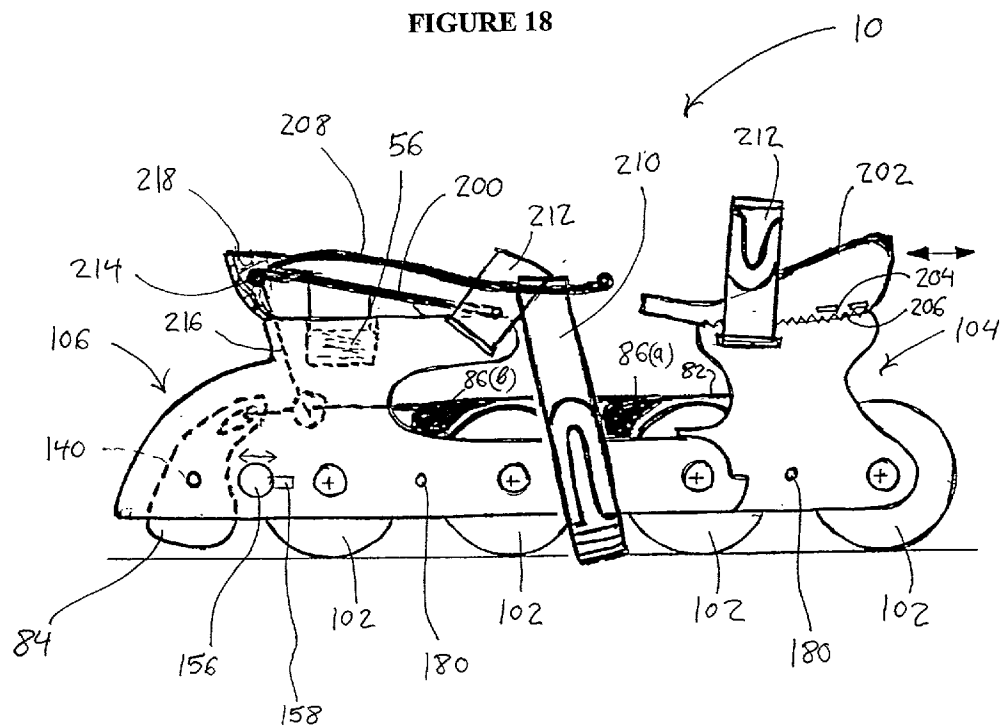


FIGURE 18



IN-LINE SKATE

TECHNICAL FIELD

[0001] This invention relates to in-line skates, and, more particularly, to an improved in-line skate with novel foot holding, brake, shock-absorption and wheel assemblies.

BACKGROUND

[0002] In-line skates are well known and their use is increasingly prevalent. Conventional in-line skates, however, have a number of shortcomings.

[0003] The most pressing problem associated with conventional in-line skates is the braking systems. The standard braking system is comprised of a brake pad positioned behind the rearmost wheel of each skate so that a skater can drag the pad along the ground by raising the toes of one of his or her feet. Only one of the brake pads can be engaged with the ground at any given time, or the skater will become unbalanced. Furthermore, this method of braking is of limited usefulness if the skater is moving quickly and needs to stop within a short distance or is traversing a steep hill.

[0004] Various attempts have been made to improve upon conventional in-line skate braking systems. In U.S. Pat. No. 5,351,974 to Cech, an in-line skate is provided with a brake pad that can be forced into frictional engagement with a wheel by activation of a hand operated actuator.

[0005] In U.S. Pat. Nos. 5,211,409, 5,253,882, 5,316,325, 5,564,718, 5,664,794, 5,704,619 and 5,992,862 to Mitchell et al., an assortment of delivery mechanisms for forcing the brake pads of in-line skates into engagement with the ground are disclosed. With reference to the '619 patent, **FIG. 1** shows a rocker arm delivery mechanism, **FIG. 6** shows a carriage delivery mechanism, **FIG. 10** shows a plunger delivery mechanism, **FIG. 11** shows a side rail delivery mechanism, and **FIG. 21** shows an integrated delivery mechanism. These delivery mechanisms are all activated by an activation mechanism (which could be a cable actuator, a wireless electromechanical actuator, or a thin wire electromechanical activator) and they all perform substantially the same basic function of forcing the brake pads into frictional engagement with the skating surface.

[0006] In U.S. Pat. No. 5,486,012 to Olivieri, a braking system is disclosed which employs a rotatable boot cuff operable to force a brake pad into frictional engagement with the ground when the cuff is rotated backwards.

[0007] In U.S. Pat. No. 5,647,599 to Visger et al., a braking mechanism is disclosed which can be attached to an in-line skate which a skater can operate by pulling upward on a cable which in turn causes a brake pad to frictionally engage the ground.

[0008] In U.S. Pat. No. 5,865,445 to Svensson et al., a hydraulic braking system is disclosed that is activated by the skater rotating a cuff towards the rear of the in-line skate.

[0009] In U.S. Pat. No. 5,951,027 to Oyen et al., an in-line skate is disclosed with a braking system that can be used when a skater is going backward. **FIGS. 28 and 29** show how the braking system of **FIG. 30** is progressively engaged to ultimately lock the wheel.

[0010] Another problem with in-line skates is the lack of stability. It is inconvenient for a skater to be required to

remove a pair of in-line skates and don non-rolling footwear for a brief interval, such as, to enter a store to make a purchase, or to ride the bus to and from a skating destination. Additionally, it can be dangerous for a skater who attempts to climb stairs without first removing the in-line skates if there is no way to stabilize the skates and prevent them from rolling. Accordingly, there have been various prior art systems disclosed for locking the wheels of in-line skates which are aimed at addressing this problem.

[0011] In U.S. Pat. No. 3,900,203 to Kukulowicz an in-line skate is provided with brake plates which can be biased against the hubs of the wheels in order to lock the wheels.

[0012] In U.S. Pat. No. 5,772,220 to Gaster, at least one walking member is coupled to an in-line skate, so that when the walking member is engaged the skate will not roll.

[0013] In U.S. Pat. No. 5,575,489 to Oyen et al., an in-line skate is provided with a front wheel lock (see **FIG. 25**) that can be activated by striking the head of the locking mechanism against a solid object.

[0014] In U.S. Pat. No. 5,951,027 to Oyen et al. an in-line skate is provided with both front and rear wheel locks which a skater can activate by engagement with the ground.

[0015] Even in-line skates that are provided with systems for locking the wheels can be dangerous for walking, because the rigid nature of the skates themselves make walking with a normal gait impossible. A skater can not bend his or her foot while walking in any of the prior art in-line skates.

[0016] It is sometimes desirable to be able to convert an in-line skate into an ice skate or roller skate, and there exists a number of prior art systems that accomplish just that. For example, U.S. Pat. No. 5,129,663 to Soo provides a skate base to which either wheels or a blade may be attached with a screw and a nut. Likewise, U.S. Pat. No. 5,320,366 to Shing provides an assembly that can be used to convert an in-line skate into an ice skate, but only after removing the wheels which is time-consuming and requires the use of tools. Neither of these systems provide for converting an in-line skate into an ice skate while leaving the wheels in place.

[0017] When a skater wishes to remove their in-line skates for extended periods it is desirable that the skates be capable of being stored in as small of a space as possible. U.S. Pat. No. 5,331,752 to Johnson et al. attempts to address this need by providing an in-line skate with a cuff assembly that may be folded down into a storage position. However, this system does not have a mechanism to ensure that the cuff stays in an upright position, other than the skater's shoe and leg themselves.

[0018] It may occasionally be desirable to prevent the wheels of an in-line skate from rotating in a rearward direction, for example when skating up hills or racing. U.S. Pat. No. 6,170,837 to Ross provides a wheel assembly that only rotates in one direction. However, there is no way to selectively engage the unidirectional capacity of the wheel assembly disclosed in Ross. A user cannot therefore easily switch between unidirectional and free rolling options.

[0019] The need has therefore arisen for a versatile in-line skate which overcomes the various shortcomings of the prior art by providing improved braking, shock absorbing, and wheel locking capabilities.

SUMMARY OF INVENTION

[0020] The invention provides an in-line skate having a front end, a rear end and a longitudinal axis extending between the front and rear ends. The skate includes an upper for holding a user's foot; a ground-contacting wheel assembly comprising a plurality of wheels arranged along the skate's longitudinal axis; and a brake assembly operatively coupled to the upper for engaging the skate wheels. The upper is pivotable by the user to adjust the brake assembly between an engaged position frictionally engaging at least one of the wheels to restrain rolling movement of the wheels and a disengaged position permitting rolling movement of the wheels.

[0021] Preferably the brake assembly frictionally engages all of the wheels in the engaged position. The invention thus exhibits "all wheel" braking capability. In one aspect of the invention the brake assembly is releasably lockable in the engaged position to enable users to safely walk up and down stairs, enter stores, ride on public transit or the like.

[0022] Preferably the brake assembly reciprocates along the longitudinal axis between the engaged and disengaged positions. The brake assembly may be adjusted to the engaged position when the upper is pivoted by the user. More particularly, the skate may further include at least one lever arm extending between the upper and the brake assembly, wherein pivoting motion of the upper causes displacement of the brake assembly between the engaged and disengaged positions. The brake assembly may include an elongated brake rod extending along the longitudinal axis above the wheels; and a plurality of brake pads extending downwardly from the rod, wherein each of the brake pads engages a separate one of the wheels in the engaged position.

[0023] The wheel assembly includes a frame supporting the wheels in spaced relation and also supporting the brake assembly for movement between the engaged and disengaged positions. Preferably a rear one of the brake pads is pivotably coupled to the frame, whereby contact of a lower portion of the rear brake pad with the ground causes pivoting motion of an upper portion of the rear brake pad to a braking position frictionally engaging one of the wheels closest to the rear end of the skate. Thus, in this aspect of the invention, a "double brake" is provided for simultaneously engaging both the ground and the rear skate wheel. This double brake feature is in addition to the "all wheel brake" mechanism described above.

[0024] The wheel assembly frame preferably includes opposed first and second side sections. A plurality of axles extend transversely between the first and second side sections for supporting the plurality of wheels. The brake rod further includes an elongated slot formed therein proximate the rear end of the skate. The rear brake pad comprises a pivot pin extending through the slot between the first and second side sections of the frame, the pin being movable relative to the slot during the pivoting motion of the rear brake pad. Preferably the pivot pin extends through a central portion of the rear brake pad.

[0025] Advantageously, the wheel assembly frame comprises separate front and rear frame sections which are pivotably coupled together. Similarly, the brake rod may also be comprised of a plurality of separate segments which

are pivotably coupled together. This structure enable users to walk in the applicant's skates with a normal gait.

[0026] In one preferred embodiment of the invention the upper may comprise a footbed for supporting the sole of the user's foot; a heel restraint extending upwardly from the footbed proximate the rear end for restraining movement of the user's heel; and a toe restraint extending upwardly from the footbed proximate the front end for restraining movement of a forward portion of user's foot. At least one of the heel restraint and the toe restraint is adjustable in position relative to the footbed for accommodating footwear of different sizes (including different users having different size feet). The upper may also include an ankle support coupled to the heel restraint. In one embodiment of the invention an upper portion of the lever arm is coupled to the ankle support and is adjustable between a locked position rigidly coupling the ankle support and the lever arm together and an unlocked position permitting pivoting motion of the ankle support relative to the lever arm.

[0027] A shock absorber extends between the upper and the wheel assembly frame in a rear portion of the skate. The shock absorber comprises a spring having a lower end captured within a recess formed in the frame and an upper end coupled to an undersurface of the upper. A roller element is located in a forward portion of the upper for pivotably coupling the upper and the frame together, the roller element being movable relative to a pivot axis intersecting the longitudinal axis of the skate.

[0028] The skate further includes an adjustable clutch assembly coupled to the frame which is adjustable between a first position permitting free rolling motion of the wheels and a second position restraining rearward rotation of the wheels. The clutch assembly includes a clutch bar extending parallel to the longitudinal axis and a plurality of wheel assembly engagement elements positioned on the clutch bar for restraining rearward rotation of the wheels in the second position. The clutch bar may include a plurality of segments pivotably coupled together in a manner similar to the wheel assembly frame and the brake rod. The clutch bar is manually displaceable in a direction parallel to the skate's longitudinal axis to adjust the clutch assembly between the first and second positions. The wheel assembly engagement elements may include slots formed at spaced intervals in the clutch bar for capturing the wheel axles or protrusions extending from the clutch bar positionable in mating recesses formed in the skate wheels.

[0029] Ice skate and roller skate attachments are releasably connectable to the frame and are preferably height adjustable.

BRIEF DESCRIPTION OF DRAWINGS

[0030] In drawings which illustrate embodiments of the invention, but which should not be construed as restricting the spirit or scope thereof,

[0031] FIG. 1 is an isometric view of one embodiment of an in-line skate having an adjustable heel restraint.

[0032] FIG. 2 is an exploded, isometric view of the in-line skate of FIG. 1.

[0033] FIG. 3A is a top plan view of the heel restraint showing the size adjustment slot and fastener.

[0034] FIG. 3B is an enlarged, cross-sectional view showing the heel restraint and shock absorber connected to the wheel assembly.

[0035] FIG. 4 is an exploded, isometric view of an alternative embodiment of applicant's in-line skate having an adjustable toe restraint.

[0036] FIG. 5 is a side elevational view of the in-line skate of FIG. 4.

[0037] FIG. 6 is a top plan view of the toe restraint of FIG. 4 showing the size adjustment slot and fastener.

[0038] FIG. 7 is an isometric view of the in-line skate of FIG. 1 with the ankle support adjusted to a folded position.

[0039] FIG. 8 is a side elevational view of the skate of FIG. 1 with a side section of the wheel assembly frame removed for purposes of clarity.

[0040] FIG. 9A is an exploded isometric view of a portion of a first clutch assembly constructed according to the invention comprising a slotted clutch bar for releasably capturing a wheel axle.

[0041] FIG. 9B is a partial side elevational view of the assembly of FIG. 9A showing the clutch bar in a disengaged position.

[0042] FIG. 9C is a partial side elevational view of the assembly of FIG. 9A showing the clutch bar in an engaged position.

[0043] FIG. 10 is a side elevation view of an alternate clutch assembly embodiment showing the clutch bar in an engaged position.

[0044] FIG. 11A is a cross-sectional view taken along the line XI-XI of FIG. 10 showing the engagement of the clutch bar and the skate wheels to restrain rearward rotation of the skate wheels.

[0045] FIG. 11B is a view of the structure of FIG. 11A showing one of the clutch bar protrusions disengaged from a wheel recess to enable rotation of the skate wheel.

[0046] FIG. 12 is a side elevational view of a portion of the clutch bar of FIG. 10 in a disengaged position.

[0047] FIG. 13 is an isometric view of an ice skate blade accessory constructed according to the invention.

[0048] FIG. 14 is an isometric view of a roller skate accessory constructed according to the invention.

[0049] FIG. 15 is a side elevation view of the in-line skate with the ice skate blade accessory of FIG. 13 attached thereto.

[0050] FIG. 16 is a side elevation view of the in-line skate with two of the roller skate accessories of FIG. 14 attached thereto.

[0051] FIG. 17 is a side elevational view of an alternative embodiment of a portable in-line skate constructed according to the invention.

[0052] FIG. 18 is a side elevational view of the in-line skate of FIG. 17 with the ankle brace adjusted to a folded position.

DESCRIPTION

[0053] The applicant's in-line skate 10 is shown in its assembled configuration in FIG. 1. Skate 10 includes a foot holding assembly or upper 12, a brake assembly 14 and a wheel assembly 16 which are connected together as described below. FIG. 2 illustrates assemblies 12-16 in an exploded configuration for illustrative purposes.

[0054] As best seen in FIG. 2, foot holding assembly 12 comprises a foot support 18 and an ankle support 20. Foot support 18 is preferably formed from a flexible material and includes a footbed 24 for supporting the sole of the user's foot. The front portion of foot support 18 includes a toe restraint 26 extending upwardly from footbed 24. Toe restraint 26 is shaped to receive a toe portion of a user's foot and to prevent the foot from sliding forwardly or lifting upwardly away from footbed 24. A roller element 28 is mounted in a forward portion of toe restraint 26 and extends downwardly therefrom. Roller element 28 has a transverse aperture formed therein for receiving a pin fastener 30. As described further below, roller element 28 pivotably connects a forward portion of foot holding assembly 12 to wheel assembly 16.

[0055] A medial tab 32 and a lateral tab 34 extend upwardly from a central portion of foot support 18. A strap fastener 36 is attached to an upper portion of lateral tab 34 for fastening tabs 32, 34 together. Fastener 36 may comprise, for example, loop-type VELCRO™ material for engaging hook-type VELCRO™ material (not shown) on tab 34. Strap 36 is adjustable to pull tabs 32 and 34 together so that the user's foot is held firmly within foot support 18.

[0056] Foot holding assembly 12 is adjustable to fit footwear of varying sizes. In one embodiment of the invention, a plurality of teeth 38 project upwardly from a rear portion of footbed 24. An aperture 40 extends through teeth 38 (FIG. 2). Foot support 18 also includes a heel restraint 42 having a plurality of teeth 44 formed on an undersurface thereof. Teeth 44 engage teeth 38 when heel restraint 42 and footbed 24 are coupled together. Heel restraint 42 has an elongated adjustment slot 46 formed in the base 47 thereof which is alignable with aperture 40 of footbed 24. A fastener 48 is insertable through slot 46 and aperture 40 to releasably couple heel restraint 42 to footbed 24 at the desired position. As shown best in FIGS. 3A and 3B, slot 46 is positioned within an elongated oval recess 52 so that when screw 48 is tightened and teeth 44 are engaged with teeth 38, the head of screw 48 does not protrude above base 47 of heel restraint 42.

[0057] As shown best in FIG. 3B, the lower end of fastener 48 is connectable to a shock absorber 50 extending between foot holding assembly 12 and wheel assembly 16. In particular, shock absorber 50 includes an outer cylinder 54 for housing an upper portion of a spring 56. Outer cylinder 54 includes a threaded collar 58 for receiving fastener 48. A lower portion of spring 56 is positionable in a recess 60 formed in wheel assembly 16, as discussed further below.

[0058] When fastener 48 is loosened, heel restraint 42 can be adjusted in position until the rear wall thereof is flush against the heel of a user's foot when the front of the user's foot is held snugly in toe restraint 26. After heel restraint 42 is in the desired location, fastener 48 may be tightened as

described above until teeth **44** and teeth **38** are securely engaged, thereby preventing any movement of heel restraint **40** relative to footbed **24**. Foot holding assembly **22** can thus be sized to accommodate a user wearing anything from boots, street shoes, running shoes, socks or bare feet. Of course, foot holding assembly **22** may also be easily adjusted to fit different users having varying foot sizes (for example, in a skate rental shop). As will be apparent to a person skilled in the art, skate **20** may optionally include a conventional boot insert (not shown) removably positionable within foot support **30** for use in the case of users wishing to wear socks (or bare feet) only.

[0059] In an alternative embodiment of the invention shown in FIGS. 4-6, toe restraint **26** may be adjustable in position for fitting purposes rather than heel restraint **42**. More particularly, toe restraint **26** may be separable from the remainder of foot support **18**. In this embodiment a plurality of teeth **38** are formed on the undersurface of toe restraint **26** for engaging a mating set of teeth located on an upper forward region of footbed **24**. As shown best in FIG. 6, in this embodiment adjustment slot **46** is provided in toe restraint **26** for receiving fastener **48**. Foot holding assembly **22** may thus be adjusted to accommodate footwear of different sizes in a manner similar to the embodiment of FIGS. 1-3 described above. When fastener **48** is loosened, toe restraint **26** can be positioned so that it is flush against the front of the user's foot when the rear of the user's foot is held snugly in heel restraint **42**. After toe restraint **26** is in the desired location, fastener **48** may be tightened until teeth **44** and teeth **38** are securely engaged, thereby preventing any movement of toe restraint **26** relative to footbed **24**. As shown in FIG. 6, slot **46** is positioned within an elongated oval recess **52**, so that when fastener **48** is tightened and teeth **44** are engaged with teeth **38**, the head of fastener **48** does not protrude above the base of toe restraint **26**, as in the alternative embodiment described above.

[0060] In both of the alternative embodiments described above ankle support **20** is pivotally attached to heel restraint **42** by means of threaded pins **62** (only one of which is shown in FIG. 2). Ankle support **20** is provided with threaded holes **64** in a lower portion thereof for receiving pins **62**. Pins **62** also releasably couple lever arms **70** to ankle support **20** as discussed further below. As shown in FIG. 2, holes **64** are alignable with holes **66** formed in the sides of heel restraint **42**. Pins **62** are inserted through threaded holes **64** until their ends extend into holes **66**, thereby allowing ankle support **20** to rotate relative to heel restraint **42** about an axis passing through holes **64**, **66**. As shown in FIG. 7, ankle support **20** is adjustable to a folded position when pins **62** are loosened. Accordingly, in-line skate **10** may be folded to a compact size for ease of carrying or the like.

[0061] As shown in FIG. 2, an upper portion of ankle support **20** includes a medial tab **72** and a lateral tab **74**. A strap **76** is attached to the forward portion of medial tab **72**, and a strap fastener (not shown) is attached to the forward portion of lateral tab **74**. Strap **76** is adjustable to pull tabs **72**, **74** together so that a user's ankle is held firmly in ankle support **20**.

[0062] Ankle support **20** is operatively coupled to brake assembly **14** by means of lever arms **70**. Lever arms **70** have holes **78** in their upper ends. When pins **62** are inserted through holes **78** and tightly screwed into threaded holes **64**

(as described above), lever arms **70** are rigidly coupled to ankle support **20**. In one embodiment of the invention, the lower end of each lever arm **70** comprises a pair of spaced-apart pins **80** which are configured to couple each arm **70** to brake assembly **14** as discussed further below. Alternatively, the lower end of lever arm **70** could have some other similar configuration, such as a single tapered pin **80** (not shown).

[0063] As shown best in FIG. 2, brake assembly **14** includes an elongated brake rod **82** for supporting a rear brake pad **84** and a plurality of spaced-apart forward brake pads **86(a)**, **86(b)** and **86(c)**. Rod **82** also supports a pair of laterally extend lever receivers **88** for receiving lever arm pins **80**. In particular, each lever receiver **88** preferably includes a transversely extending bar **90**. When each lever arm **70** is inserted into a corresponding lever receiver **88**, pins **80** straddle bar **90** to pivotably couple foot holding assembly **12** to brake assembly **14**. Other equivalent means for operatively coupling assemblies **12** and **14** together may be envisaged. As described further below, when pins **62** are tightened and ankle support **20** is tilted rearwardly as shown in FIG. 8, lever arms **70** force brake rod **82**, and hence brake pads **84**, **86(a)-(c)**, to slide forwardly to apply a braking force.

[0064] As discussed further below, brake rod **82** is preferably comprised of a plurality of separate segments which are coupled together by a hinge(s) **92**. Rear brake pad **84** is pivotably coupled to rod **82** with a pin **94** which is moveable within an elongated slot **96** formed at the rear end of rod **82**. Forward brake pads **86(a)** are fixedly mounted on brake rod **82**.

[0065] Wheel assembly **16** includes a frame **100** for supporting in-line skate wheels **102** at spaced locations. Frame **100** preferably includes a front portion **104** and a rear portion **106** which are pivotably coupled together. As discussed further below, this allows users to walk with a normal gait when brake assembly **14** is locked in an engaged position. Each frame portion **104**, **106** includes opposed symmetrical side sections **108** and **110** for housing wheels **102** therebetween. Wheel axles **111** extend transversely between side sections **108**, **110** for supporting wheels **102**.

[0066] An upper section **112** of front frame portion **104** includes a flange **114** for supporting the undersurface of footbed **24** and a cradle **116** for receiving roller element **28** when foot holding assembly **12** and wheel assembly **16** are coupled together. Flange **114** and cradle **116** include apertures **118** for receiving pivot pin **30** of roller element **28**. An upper section **120** of rear frame portion **106** includes a platform **122** and a pair of lateral flanges **124** for supporting a rear portion of footbed **24** when foot holding assembly **12** and wheel assembly **16** are coupled together. Platform **122** has recess **60** formed therein for receiving a lower portion of spring **56** of shock absorber **50** (FIG. 3B). As will be apparent to a person skilled in the art, the combination of shock absorber **50** and roller element **28** allows for pivotable displacement of foot holding assembly **12** relative to wheel assembly **16** (for example, within a pivot range of approximately 35 degrees). This arrangement allows for spring **56** to absorb some of the shock that would otherwise be transferred through wheel assembly **16** to foot holding assembly **12**, thereby improving the rideability and performance of skate **10**.

[0067] As shown in FIG. 2, brake assembly **14** of skate **10** is disposed within wheel assembly **16** below upper sections

112, 120 in close proximity to wheels **102**. Brake rod **82** is supported by frame **100**, such as by inverted U-shaped brackets (not shown), for reciprocal sliding movement along the longitudinal axis of skate **10**. When brake assembly **14** is disengaged, brake pads **84** and **86(a)-(c)** are spaced-apart from respective skate wheels **102**. When brake rod **82** is displaced forwardly, brake pads **84** and **86(a)-(c)** are brought into frictional engagement with respective skate wheels **102** to apply a braking force to all of the wheels **102**. As shown in **FIG. 8**, adjustment of the brake assembly between the disengaged and engaged positions may be activated by the user by tilting ankle support **20** rearwardly in the direction of arrow **130** when pin **62** is tightened as discussed above. This causes lever arms **70** to pivot forwardly in the direction of arrow **132**. Since pins **80** located at the lower end of arms **70** are pivotably coupled to lever receivers **88** of brake assembly **14**, this in turn causes forward displacement of brake rod **82** in the direction of arrow **134** until brake pads **84** and **86(a)-(c)** frictionally engage wheels **102**.

[0068] Brake assembly **14** may be locked in the forward, engaged position by manually inserting a locking pin **136** mounted on frame side section **108** into an aperture **138** located in a rear portion of brake rod **82** (**FIG. 2**). As will be apparent to a person skilled in the art, locking pin **136** may be positioned on frame **100** to engage rod **82** at other locations (for example, aperture **138** could alternatively be formed in a front portion of rod **82**).

[0069] An important advantage of applicant's invention is that skates **10** can be worn comfortably in environments where rolling motion of wheels **102** is undesirable, such as in shopping malls, on public transit and the like. The user need only lock brake assembly **14** in the engaged position as discussed above and loosen pin **62** so that ankle support **20** is pivotable relative to lever arms **70** and hence the remainder of foot support **18**. Further, in a preferred embodiment, foot support **18** is formed from a flexible material and brake rod **82** and wheel assembly frame **100** are constructed of a plurality of separate sections which are pivotably coupled together as discussed above. The combination of these features enables skate **10** to flex when the user walks with a normal gait with brake assembly **14** engaged. The user can also safely walk up and down stairs and the like which is difficult in conventional in-line skates having a rigid shell.

[0070] As shown best in **FIGS. 2 and 8**, rear brake pad **84** is preferably coupled to frame **100** by means of a pivot pin **140** extending between frame side sections **108, 110** through an aperture **142** formed in a central lower portion of pad **84**. Since the upper portion of brake pad **84** is pivotably coupled to brake rod **82** as discussed above (i.e. pivot pin **94** is movable within brake rod slot **96**), engagement of a lower portion of brake pad **84** with the ground causes an upper portion of brake pad **84** to rotate in a clockwise direction into frictional engagement with the rearmost skate wheel **102**. Thus, in this aspect of the invention, brake assembly **14** is activated when the user raises wheels **102** off the ground in a conventional in-line skate braking motion except for the rearmost wheel **102**. Unlike conventional in-line skate brakes, brake pad **84** simultaneously engages both the ground and the rearmost wheel **102**, thereby providing a "double braking" function.

[0071] In one embodiment of the invention, in-line skate **20** may further include a clutch assembly generally desig-

nated **150** for restraining rearward rolling motion of wheels **102** (**FIG. 8**). Clutch assembly **150** is useful, for example, for hill climbing or racing purposes. Assembly **150** includes a clutch bar **152** which is attached to wheel assembly **16** and extends longitudinally between wheels **102** and frame side section **108** (as shown in dotted lines in **FIG. 2**). In this embodiment clutch bar **152** has a plurality of axle apertures **154** formed therein arranged at spaced intervals. Bar **20** is longitudinally slidable between engaged and disengaged positions and includes a clutch engagement pin **156** threadedly attached to a rear portion of clutch bar **152**. In alternative embodiments, pin **156** could be coupled to a forward portion of bar **152** or any other intermediate portion. Clutch engagement pin **156** extends through a slot **158** formed in frame side section **108** (**FIG. 2**) and is moveable within slot **158** to adjust bar **152** between the engaged and disengaged positions, as discussed further below.

[0072] As shown in **FIG. 8**, clutch bar **152** preferably includes a plurality of separate segments which are coupled together, such as by a hinge **160**. Thus bar **152** includes separate segments which are pivotable relative to one another in a manner similar to brake rod **82**. As discussed above, this ensures that skate **10** will flex when in use, particularly in non-skating applications such as walking or stair climbing when brake assembly **14** is in the engaged position and wheels **102** are stationary.

[0073] With reference to **FIG. 9A**, each aperture **154** of clutch bar **152** comprises a rounded portion **162** and a rectangular portion **164**. In this embodiment of the invention the shaft of each axle **111** comprises a flattened portion **166** of reduced diameter. In the disengaged position (i.e. when engagement pin **156** is in a rearward position of slot **158** as shown in **FIG. 8**) axle **111** extends through rounded portion **162** and will rotate freely (**FIG. 9B**). Clutch assembly **150** may be locked in the disengaged position by tightening engagement pin **156**. Clutch assembly **150** is engaged by loosening pin **156** and sliding it forwardly within slot **158**, thereby causing advancement of clutch bar **152** to the position shown in **FIG. 9C**. In this engaged position axle portion **166** is captured within portion **164** of axle aperture **154** which prevents rotation of axle **111**. Clutch bar **152** may be locked in the engaged position by tightening engagement pin **156**.

[0074] In this embodiment of the invention the hub of each wheel **102** has a conventional clutch mechanism (not shown) housed therein for engaging the shaft of a corresponding axle **111**. An example of a suitable clutch mechanism is described, for example, in U.S. Pat. No. 6,170,837 the text and drawings of which is incorporated by reference. The clutch mechanism prevents wheel **102** from rotating in a rearward direction relative to axle **111** (i.e. in a counter-clockwise direction in **FIG. 8**). Accordingly, when rotation of axles **111** is restrained by the engagement of the applicant's clutch assembly **150** as described above, wheels **102** will rotate in a forward direction only (i.e. in a clockwise direction in **FIG. 8**). As mentioned above, this is advantageous in racing and hill climbing applications.

[0075] An alternative embodiment of the applicant's clutch assembly **150** is illustrated in **FIGS. 10 and 11A-11C**. In this embodiment an internal clutch mechanism housed within the hub of each wheel **102** is not required. Clutch bar **152** comprises multiple segments pivotably coupled

together by a hinge 160 and is adjustable by the user between disengaged and engaged positions in the same manner as the first clutch assembly embodiment described above. In the alternative embodiment axle apertures 154 are obround in shape and clutch bar 152 supports a plurality of spaced, generally semi-circular wheel engagement elements 170. Each wheel engagement element 170 includes a plurality of protrusions 172 formed thereon which extend inwardly toward a respective wheel 102. In this embodiment the hub of each wheel 102 includes a plurality of recesses 174 for receiving protrusions 172.

[0076] FIG. 11A shows a protrusion 172 fitted within a wheel hub recess 174. FIG. 11B shows the same protrusion 172 and recess 174 when wheel 102 has been rotated slightly in a forward direction. In this embodiment of the invention clutch bar 152 is biased toward wheels 102 when clutch assembly 150 is in the engaged position, such as by a leaf spring (not shown). This biasing force tends to force protrusions 172 into recesses 174. In the engaged position, rearward rotation of wheel 102 is constrained by the engagement of a shoulder portion 176 of protrusion 172 with a leading wall 178 of recess 174.

[0077] FIG. 12 shows a portion of clutch bar 152 when disengaged by moving clutch engagement pin 156 to a rearward position in clutch engagement slot 170 as discussed above. Disengaging clutch bar 152 deactivates the biasing means so that protrusions 172 do not engage recesses 174.

[0078] In one embodiment of the invention, side sections 108, 110 of wheel assembly frame 100 may include accessory attachment holes 180 (FIG. 1). Attachment holes 180 may be used to secure optional accessories, such as an ice skate blade accessory 182 (FIG. 13) comprising a blade 184 or a roller skate accessory 186 (FIG. 14) comprising wheels 188. Each accessory 182, 184 includes one or more attachment tabs 190 having a plurality of accessory attachment holes 192 formed therein.

[0079] FIG. 15 shows in-line skate 10 with ice skate blade accessory 182 attached thereto. Preferably attachment tabs 190 are slightly wider than skate wheels 102 so that they will fit snugly into wheel assembly 16 between frame side sections 108, 110. Skate blade accessory 182 is secured to frame 100 so that one of the accessory attachment holes 192 on each tab 190 is aligned with a corresponding attachment hole 180 on frame 100 and suitable fasteners are inserted through the aligned holes, such as screws 194. Since two or more accessory attachment holes 192 are provided on each tab 190, accessory 182 is height-adjustable. In the installed configuration shown in FIG. 15 ice blade 184 of accessory 182 extends below the bottom of in-line skate wheels 102 irrespective of the height level selected by the user. As will be appreciated by a person skilled in the art, by varying the height of blade 184 the feel and performance characteristics of skate 10 may be varied to suit user preferences.

[0080] FIG. 14 shows one roller skate accessory 186 unattached to in-line skate 10. FIG. 16 shows in-line skate 10 with a pair of roller skate accessories 186 attached thereto. Each skate accessory 186 is secured to wheel assembly frame 100 in the same manner as accessory 182 described above (i.e. by aligning a selected accessory attachment hole 192 with a corresponding hole 180 on frame 100 and inserting a screw fastener 194). In the installed configu-

ration illustrated in FIG. 16, the bottom of accessory wheels 188 extends in the same plane as the bottom of in-line skate wheels 102. However, accessory 186 is also height-adjustable and may be mounted so that only the roller skate accessory wheels 188 contact the ground surface. Further, the embodiment shown in FIG. 16 has a roller skate accessory 186 attached at both the front and rear portions of wheel assembly frame 16, but optionally only one roller skate accessory 110 may be used, either the forward or rearward position. For example, a user may choose to mount only one accessory 186 on frame 100 for training purposes while learning to use in-line skate 10.

[0081] FIGS. 17 and 18 show a further alternative embodiment of the invention which is collapsible to a small size and is highly portable. This embodiment employs substantially the same brake assembly 14 and wheel assembly 16 as the other embodiments described above. However, the upper, foot holding assembly 12 is modified. In particular, footbed 24 is interrupted and comprises a rear heel pad 200 only. An adjustable toe restraint 202 having teeth 204 formed on its undersurface is located at a forward end of skate 10. Toe restraint 202 is adjustable in position for footwear fitting purposes in a manner generally similar to the embodiment of FIGS. 4-6. However, in this alternative embodiment the toe restraint adjustment teeth 204 mate with teeth 206 formed on an upper surface of wheel assembly frame section 112 rather than footbed 24.

[0082] Heel pad 200 is coupled to a rear upper portion 120 of frame 100 with a shock absorbent spring 56 in the same manner as the earlier embodiments of the invention. An ankle brace 208 is pivotably coupled to heel pad 200 and is adjustable between a deployed position shown in FIG. 17 and a folded position shown in FIG. 18. An adjustable strap fastener 210 is secured to ankle brace 208 for securing foot holding assembly 12 to the user's ankle. Strap fasteners 212 are also attached to heel pad 200 and toe restraint 202 for securing foot holding assembly 12 to the article of footwear worn by the user, such as a running shoe or street shoe.

[0083] Ankle brace 208 is pivotably coupled to heel pad 200 by means of a hinge 214 which is operatively coupled to a lever arm 216 extending between hinge 214 and brake rod 82. Lever arm 216 functions in essentially the same manner as the lever arm 70 of FIG. 2. In particular, when ankle brace 208 is tilted rearwardly by the user, this causes hinge 214 to pivot lever arm 216 which in turn causes forward displacement of brake rod 82 to move brake assembly 14 to the engaged position.

[0084] As shown in FIGS. 17 and 18, foot holding assembly 12 also preferably includes a rear frame portion 218 for securely holding the user's heel in place when skate 10 is in use. This prevents the user's foot from being displaced laterally when skate 10 is in use which could otherwise result in user injury.

[0085] As shown in FIG. 18, this embodiment of skate 10 is foldable to a very compact size for ease of portability.

[0086] As will be apparent to those skilled in the art in the light of the foregoing disclosure, many alterations and modifications are possible in the practice of this invention without departing from the spirit or scope thereof. Accordingly, the scope of the invention is to be construed in accordance with the substance defined by the following claims.

What is claimed is:

1. An in-line skate having a front end, a rear end and a longitudinal axis extending between said front and rear ends, said skate comprising:

- (a) an upper for holding a user's foot;
- (b) a ground-contacting wheel assembly comprising a plurality of wheels arranged along said longitudinal axis; and,
- (c) a brake assembly operatively coupled to said upper, wherein said upper is pivotable by said user to adjust said brake assembly between an engaged position frictionally engaging at least one of said wheels to restrain rolling movement of said wheels and a disengaged position permitting rolling movement of said wheels.

2. The skate as defined in claim 1, wherein said brake assembly engages all of said wheels in said engaged position.

3. The skate as defined in claim 1, wherein said brake assembly is releasably lockable in said engaged position.

4. The skate as defined in claim 1, wherein said brake assembly reciprocates along said longitudinal axis between said engaged and disengaged positions.

5. The skate as defined in claim 4, wherein said skate further comprises at least one lever arm extending between said upper and said brake assembly, wherein pivoting motion of said upper causes displacement of said brake assembly between said engaged and disengaged positions.

6. The skate as defined in claim 5, wherein said brake assembly comprises:

- (a) an elongated brake rod extending along said longitudinal axis above said wheels; and
- (b) a plurality of brake pads extending downwardly from said rod, wherein each of said brake pads engages a separate one of said wheels in said engaged position.

7. The skate as defined in claim 6, wherein said wheel assembly comprises a frame supporting said wheels in spaced relation, wherein said frame further supports said braking assembly for movement between said engaged and disengaged positions.

8. The skate as defined in claim 7, wherein a rear one of said brake pads is pivotably coupled to said frame, whereby contact of a lower portion of said rear one of said brake pads with the ground causes pivoting motion of an upper portion of said rear one of said brake pads to a braking position frictionally engaging one of said wheels closest said rear end.

9. The skate as defined in claim 8, wherein said frame comprises opposed first and second side sections and wherein said wheel assembly further comprises a plurality of axles extending transversely between said first and second side sections for supporting said plurality of wheels.

10. The skate as defined in claim 9, wherein said brake rod further comprises an elongated slot formed therein proximate said rear end, and wherein said rear one of said brake pads comprises a pivot pin extending through said slot between said first and second side sections of said frame, said pin being movable relative to said slot during said pivoting motion.

11. The skate as defined in claim 10, wherein said pivot pin extends through a central portion of said rear one of said brake pads.

12. The skate as defined in claim 10, wherein said pivot pin extends through a central lower portion of said rear one of said brake pads.

13. The skate as defined in claim 7, wherein said frame comprises a front section and a rear section pivotably coupled to said front section.

14. The skate as defined in claim 13, wherein said brake rod comprises a plurality of segments which are pivotably coupled together.

15. The skate as defined in claim 1, wherein said upper comprises:

- (a) a footbed for supporting the sole of the user's foot;
- (b) a heel restraint extending upwardly from said footbed proximate said rear end for restraining movement of the user's heel; and
- (c) a toe restraint extending upwardly from said footbed proximate said front end for restraining movement of a forward portion of the user's foot,

wherein at least one of said heel restraint and said toe restraint is adjustable in position relative to said footbed for accommodating footwear of different sizes.

16. The skate as defined in claim 5, wherein said upper comprises:

- (a) a footbed for supporting the sole of the user's foot;
- (b) a heel restraint extending upwardly from said footbed proximate said rear end for restraining movement of the user's heel; and
- (c) a toe restraint extending upwardly from said footbed proximate said front end for restraining movement of a forward portion of the user's foot, and
- (d) an ankle support coupled to said heel restraint for supporting the user's ankle,

wherein an upper portion of said lever arm is coupled to said ankle support and is adjustable between a locked position rigidly coupling said ankle support and said lever arm together and an unlocked position permitting pivoting motion of said ankle support relative to said lever arm.

17. The skate as defined in claim 16, wherein said braking assembly comprises a pair of said lever arms disposed on opposite sides of said ankle support.

18. The skate as defined in claim 7, further comprising a shock absorber extending between said upper and said frame in a rear portion of said skate.

19. The skate as defined in claim 18, wherein said shock absorber comprises a spring having a lower end captured within a recess formed in said frame and an upper end coupled to an undersurface of said upper.

20. The skate as defined in claim 19, further comprising a roller element located in a forward portion of said upper for pivotably coupling said upper and said frame together, said roller element being movable relative to a pivot axis intersecting said longitudinal axis.

21. The skate as defined in claim 7, further comprising an adjustable clutch assembly coupled to said frame, said clutch assembly being adjustable between a first position permitting free rolling motion of said wheels and a second position restraining rearward rotation of said wheels.

22. The skate as defined in claim 21, wherein said clutch assembly comprises:

(a) a clutch bar extending parallel to said longitudinal axis; and

(b) a plurality of wheel assembly engagement elements positioned on said clutch bar for restraining rearward rotation of said wheels in said second position.

23. The skate as defined in claim 22, wherein said clutch bar is manually displaceable in a direction parallel to said longitudinal axis to adjust said clutch assembly between said first and second positions.

24. The skate as defined in claim 23, wherein said clutch bar is lockable in said first position.

25. The skate as defined in claim 22, wherein said wheel assembly engagement elements comprise slots formed at spaced intervals in said clutch bar, wherein each of said slots is configured to permit free rotation of a corresponding one of said axles in said first position and to restrain rotation of said one of said axles in said second position.

26. The skate as defined in claim 25, wherein said clutch assembly further comprises a clutch housed within each one of said wheels coupled to a corresponding one of said axles, said clutch permitting uni-directional rotation of said one of said wheels relative to said one of said axles in said second position.

27. The skate as defined in claim 22, wherein said wheel assembly engagement elements comprise a plurality of protrusions extending inwardly from said clutch bar and wherein said wheels comprise a plurality of recesses shaped for receiving said protrusions, wherein engagement between said protrusions and said recesses restrains rearward rotation of said wheels in said second position.

28. The skate as defined in claim 27, wherein said clutch assembly further comprises a biasing element for biasing said clutch bar into engagement with said wheels in said second position.

29. The skate as defined in claim 22, wherein said frame comprises a front section and a rear section pivotably coupled to said front section, and wherein said clutch bar comprises a plurality of segments which are pivotably coupled together.

30. The skate as defined in claim 7, further comprising an ice skating blade attachment releasably connectable to said frame.

31. The skate as defined in claim 7, further comprising a roller skate attachment releasably connectable to said frame.

32. An in-line skate for rolling movement over a ground surface comprising:

(a) an upper for holding a user's foot;

(b) a wheel assembly comprising a plurality of wheels supported by a frame; and

(c) a brake assembly coupled to said frame, wherein said brake assembly comprises a rear brake pad pivotably

coupled to said frame and having an upper portion and a lower portion, wherein frictional engagement of said lower portion with said ground surface causes said upper portion to pivot into frictional engagement with a rearmost one of said wheels.

33. The skate as defined in claim 32, wherein said braking assembly further comprises a brake rod supported by said frame, wherein said brake rod comprises an elongated slot located proximate a rear end thereof, and wherein said skate further comprises a pivot pin coupling said rear brake pad to said frame which is displaceable in said slot.

34. The skate as defined in claim 33, further comprises a plurality of forward brake pads extending from said brake rod at spaced locations forwardly of said rear brake pad, wherein said brake rod is displaceable between an engaged position wherein said rear brake pad engages said rearmost wheel and each of said forward brake pads frictionally engages one of said wheels other than said rearmost one of said wheels; and a disengaged position wherein said rearmost brake pad is disengaged from said rearmost wheel when said rearmost brake pad is spaced above the ground surface and said forward brake pads are disengaged from said wheels other than said rearmost one of said wheels.

35. The skate as defined in claim 34, wherein said brake rod is operatively coupled to said upper, said upper being moveable by said user to adjust said brake rod between said engaged and disengaged positions.

36. The skate as defined in claim 1, wherein said upper comprises:

(a) a footbed for supporting the user's foot;

(b) an ankle brace pivotably coupled to a rear end of said footbed and adjustable between a deployed and a folded position; and

(c) a lever arm having an upper end coupled to said ankle brace and a lower end engaging said brake assembly,

wherein rearward pivoting movement of said ankle brace by said user causes said lever arm to displace said brake assembly between said engaged and disengaged positions.

37. The skate as defined in claim 36, wherein said skate further comprises a toe restraint for receiving a forward portion of the user's foot, wherein said toe restraint is adjustably connectable to a forward portion of said wheel assembly.

38. The skate as defined in claim 37, wherein said footbed and said toe restraint are spaced-apart and said user's foot is unsupported at locations between said footbed and said toe restraint.

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