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Svensson

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[54] **IN-LINE SKATE FRAME**

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[73] Assignee: **K-2 Corporation**, Vashon, Wash.

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[51] **Int. Cl.**[6] **A63C 17/06**

[52] **U.S. Cl.** **280/11.22**

[58] **Field of Search** 280/841, 842, 280/7.13, 11.12, 11.18, 11.19, 11.22, 11.23, 11.25, 11.26, 11.27; 264/162, 177.1, 177.16

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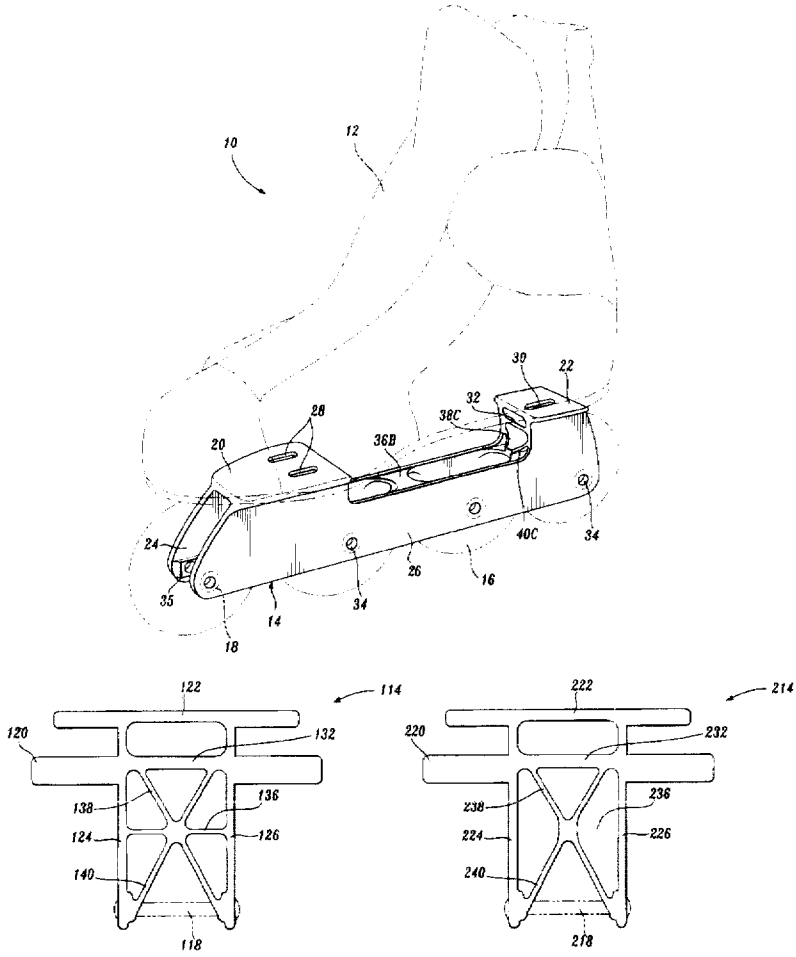
[57] **ABSTRACT**

A frame for securing in-line skate wheels to a skate boot includes mounting platforms, right and left walls, and cross braces between the walls. The mounting platforms are adapted for securing a skate boot to the frame. The right and left walls extend downwardly from the mounting platform and include lower regions having apertures for securing the wheels thereto. The apertures of the walls are substantially aligned. The cross braces extend diagonally down from either the mounting platform or the walls to the lower portions of the walls. The cross braces extend substantially along the plane substantially parallel to the longitudinal axis of the frame. A method of constructing an in-line skate frame is also provided.

22 Claims, 4 Drawing Sheets



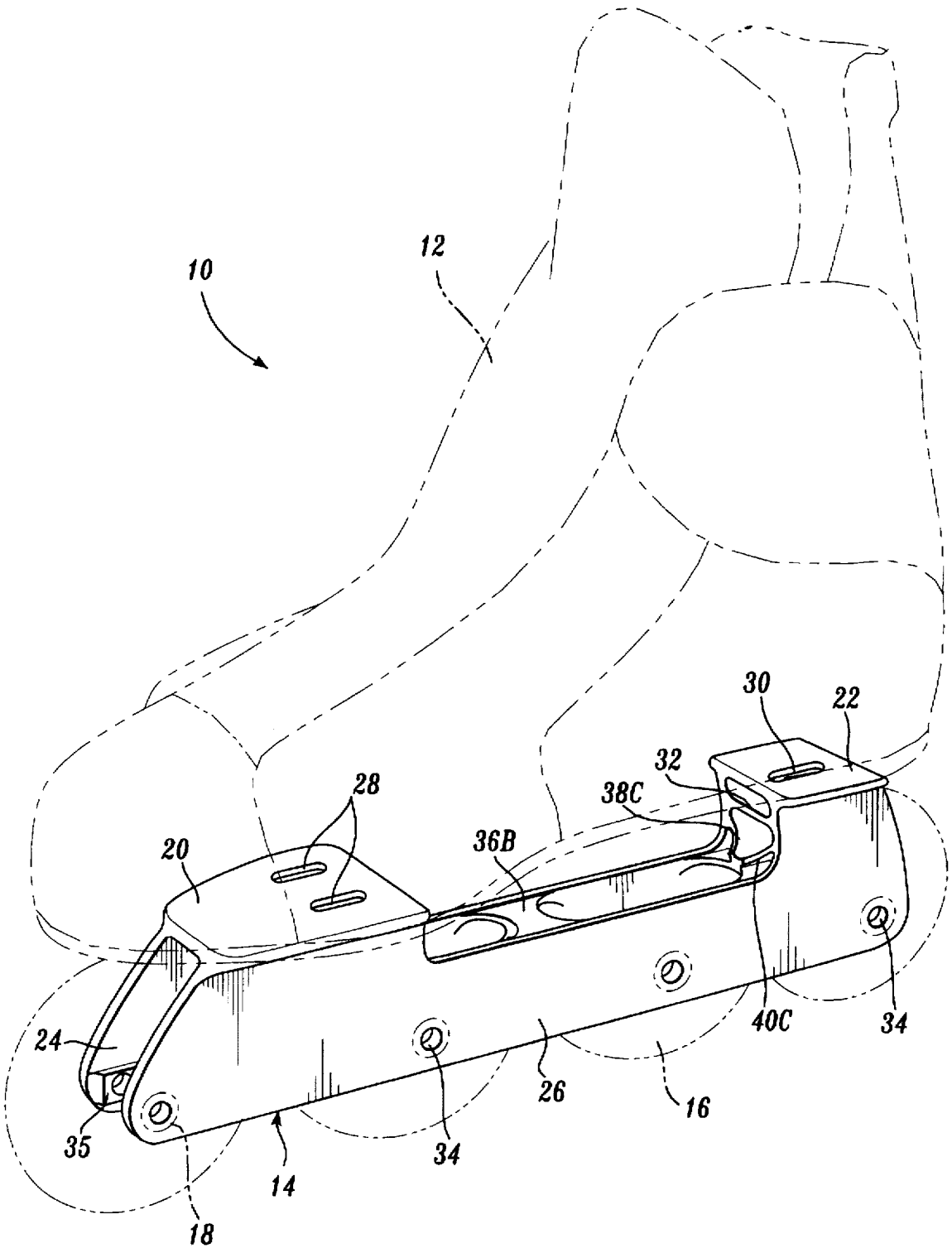


Fig. 1.

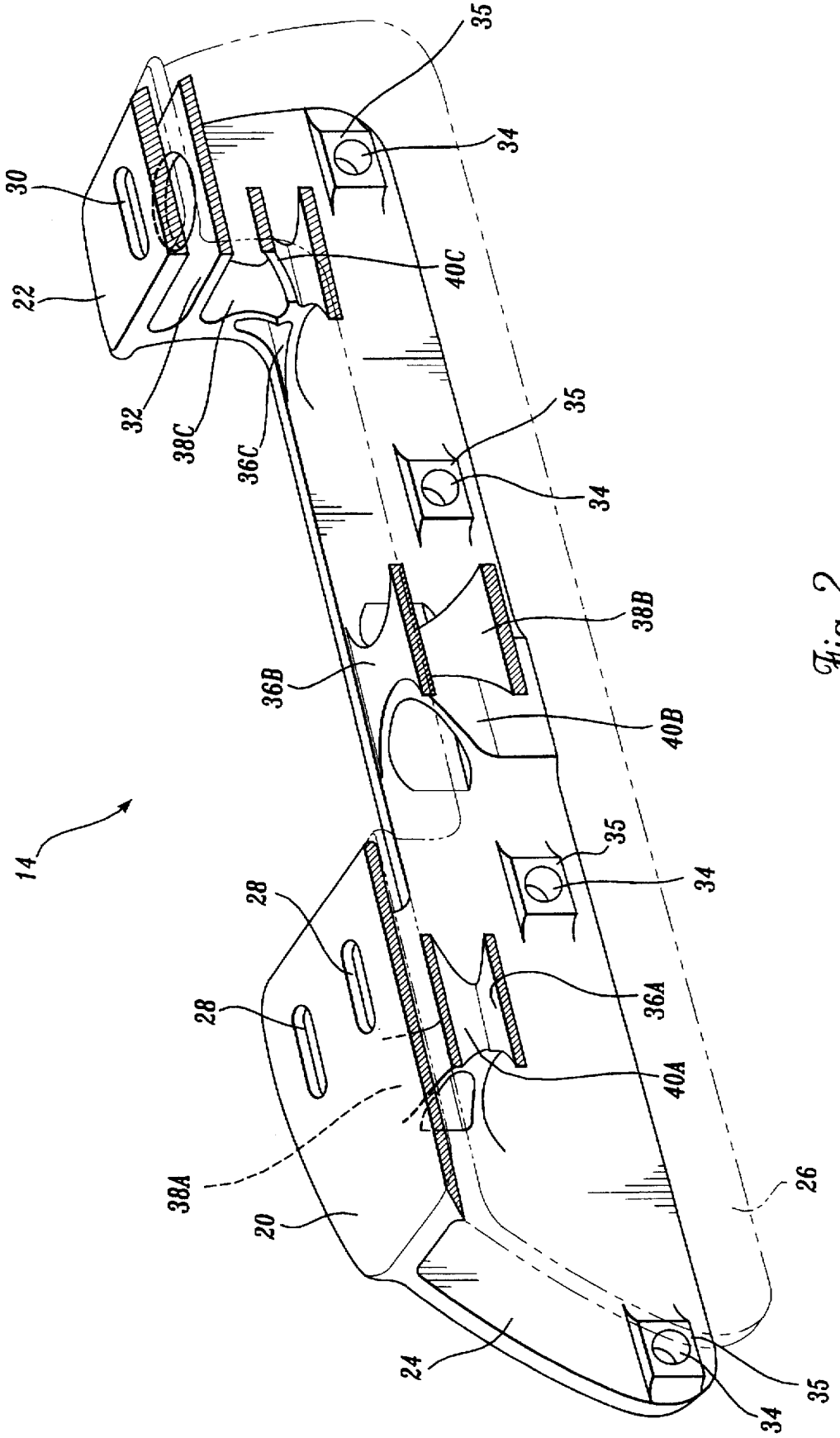

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Fig. 2.

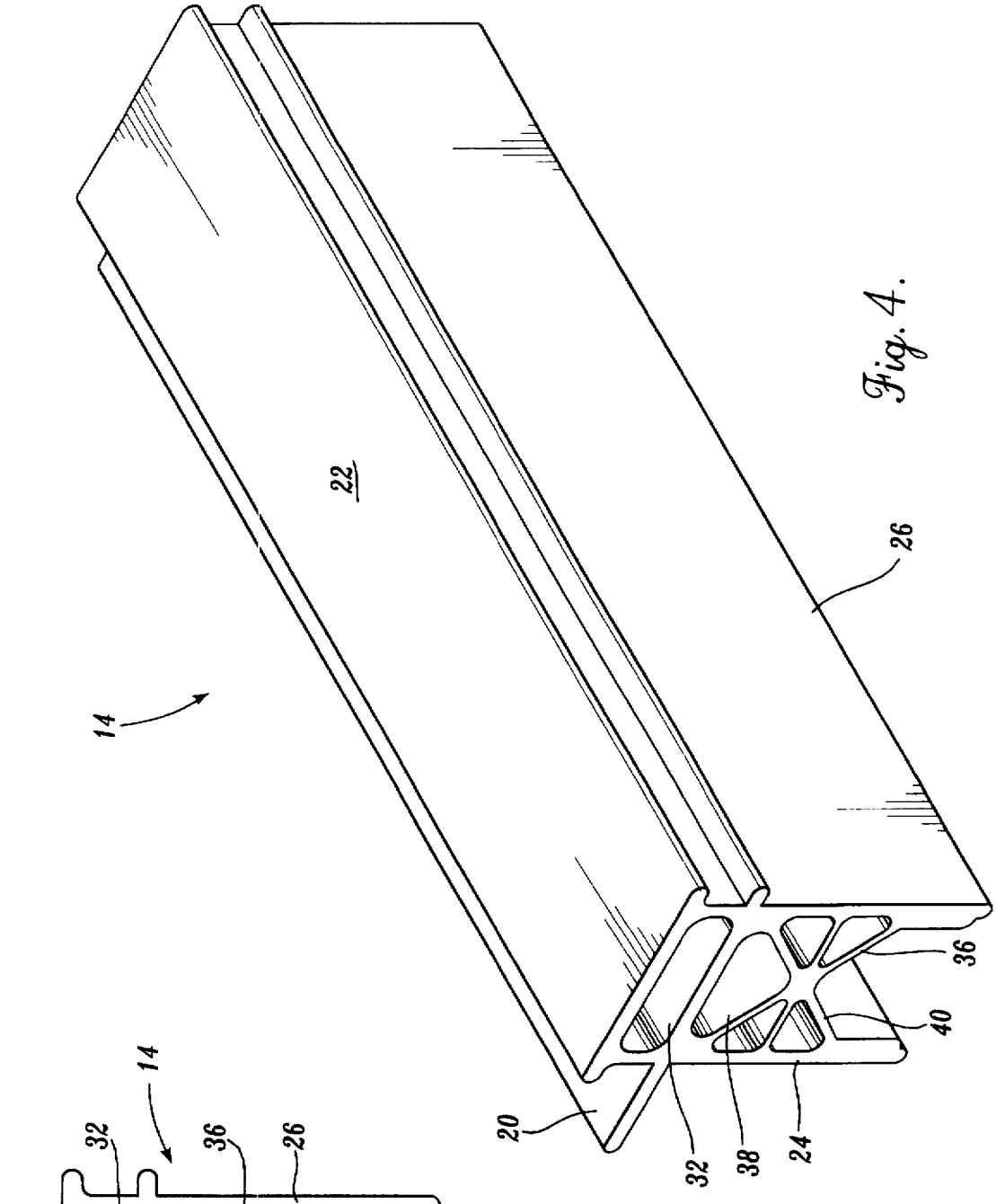

Fig. 4.

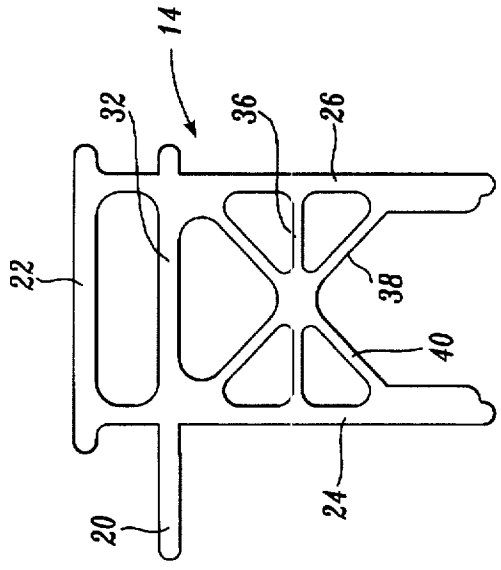

Fig. 3.

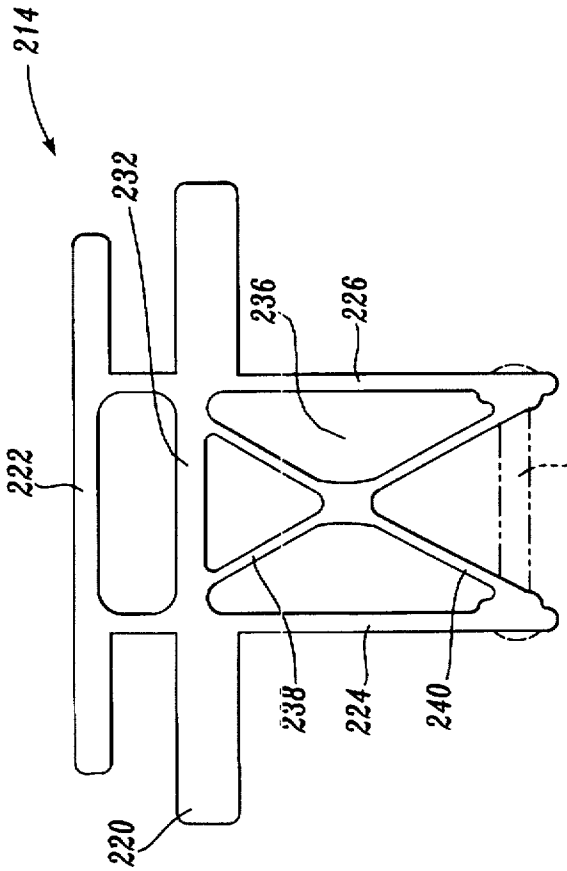

Fig. 6.

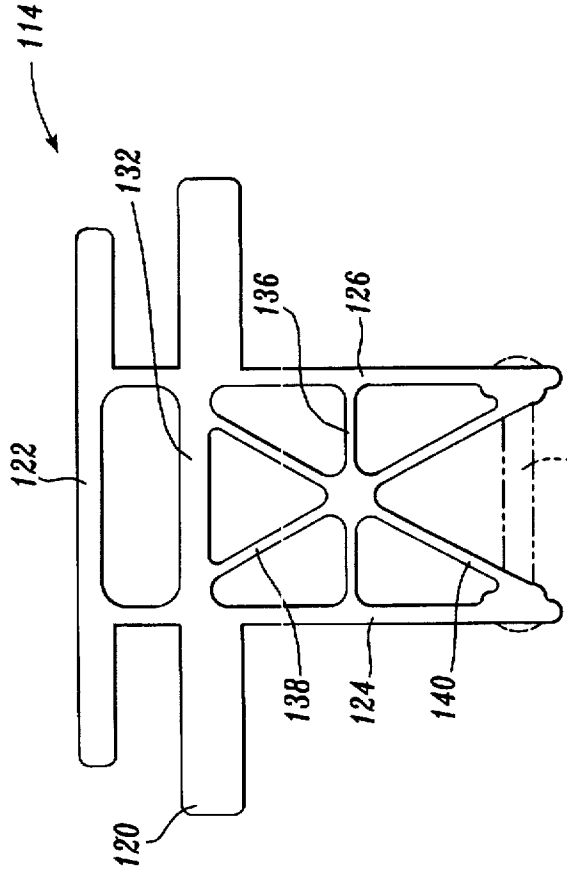

Fig. 5.

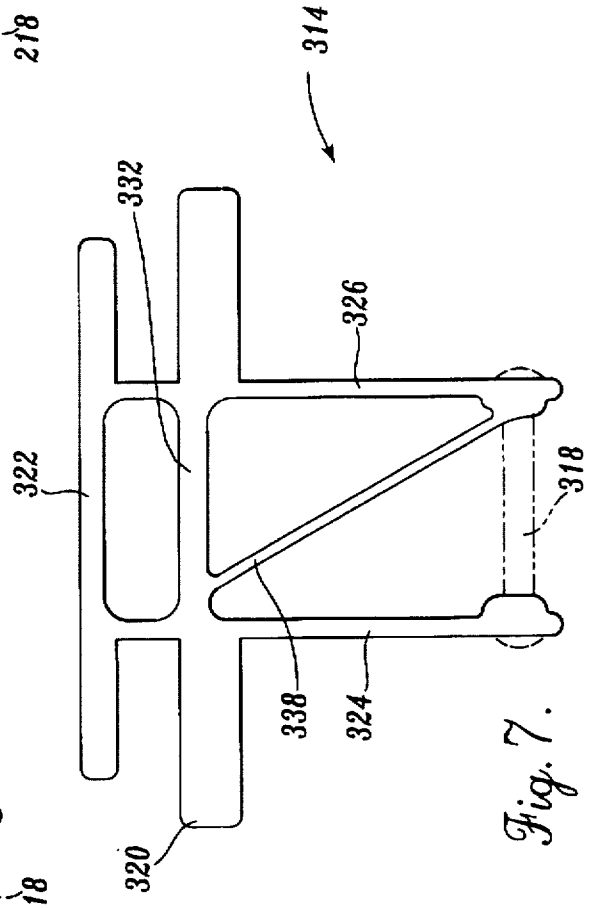

Fig. 7.

IN-LINE SKATE FRAME

FIELD OF THE INVENTION

The present invention relates to frames for securing in-line skate wheels to a skate boot and, more particularly, to an extruded aluminum in-line skate frame with braces.

BACKGROUND OF THE INVENTION

In-line roller skates include multiple wheels all rotating in a common plane such that a single row of wheels is created beneath each foot of the skater. The construction provides a skater with much of the same feel experienced on an ice skate, while the in-line roller skate may be used on a much wider variety of terrain.

Typical in-line skates include four or five wheels of the same size having parallel axes of rotation within the same horizontal plane, perpendicular to the longitudinal axis of a frame. All of the wheels are carried and rotatably supported within the lower frame. The frame is attached to the base of a shoe or boot. The frame configuration determines the number, size, and location of the in-line wheels used with the skate.

Frames usually vary depending on the intended end use of the skate. Long frames are constructed for speed skating to accommodate five large-diameter wheels. Hockey frames are typically shorter and hold three or, more likely, four wheels. The wheels are fatter and shorter in diameter.

The high speeds of speed skates result from significant lateral thrusting of the skater's legs to the sides. Thus, the long frames and large wheels of a speed skate help the skater attain and maintain high speeds on roads or courses without substantial turns. While the skater angles the frame to transmit the forces efficiently through the walls to the skate boot base, the wheel is on its side. Therefore, lateral forces on the wheel and on the frame necessarily occur. If the frame flexes, forward thrust energy is lost. A light, laterally stiff frame is efficient. Most speed skating frames are constructed of aluminum. They include boot mounting platforms and walls. Some frames include horizontal braces between the walls. Such a brace forms a rectangular section in combination with the frame walls, which may help stiffen the frame if thick enough. However, such a configuration is not completely efficient at resisting lateral loads.

The hockey skate wheel and frame dimensions help the skate to maneuver quickly. A hockey player cuts, stops, turns, and reverses direction frequently and at some speed. The frames are usually made of aluminum with heel and forward platforms and downwardly extending walls. Some frames include horizontal braces between the walls. However, the resulting rectangular support structures may not efficiently counter the extreme lateral loads that often occur during hockey play. The cross sectional shape may change from rectangular to slightly trapezoidal without thick, heavy supports.

The frames of the present invention are more efficient and effective in countering lateral loads and side impacts. Instead of creating rectangular cross-sectional shapes, strong triangles are created with cross bracing. As discussed below, the cross bracing preferably extends diagonally between the walls within planes parallel to the longitudinal axis of the frame. These planes are most efficient in countering the loads encountered during skating, especially hockey and speed skating. Thus, less energy is lost and the skates are more responsive.

SUMMARY OF THE INVENTION

The present invention is directed toward a frame for securing in-line skate wheels to a skate boot. The frame includes at least one mounting platform, a right wall, a left wall, and a first cross brace. The mounting platform is adapted for securing the skate boot thereto. The right wall extends downwardly from the mounting platform and includes a lower region having apertures for securing the wheels thereto. The left wall extends downwardly from the mounting platform and also includes a lower region having apertures for securing the wheels thereto. The apertures of the walls are substantially aligned for placement of axles therebetween. The first cross brace extends diagonally down from one of the right wall and the left wall to the other of the right wall and the left wall. The first cross brace has an upwardly facing surface, a downwardly facing surface, a forward edge, and a rearward edge. The brace also has a lower end attached to one of the walls and an upper end attached to the other of the walls.

In one preferred embodiment of the invention, the first cross brace extends along a plane parallel to the longitudinal axis of the frame. The cross section of the first cross brace combined with the cross section of one of the right and left walls and the cross section of the platform, forms a triangular shape. The first cross brace is attached to one of the walls between two of the apertures. Thus, the lower end of the first cross brace is attached to the lower region of one of the walls. In this manner, the first cross brace is positioned between two wheels, when the wheels are secured to the frame.

Another aspect of the preferred embodiment of the invention includes a second cross brace extending along a plane parallel to the longitudinal axis of the frame, transverse to the first cross brace. The second cross brace extends from an upper portion of one of the walls to a lower portion of the opposite wall. A horizontal brace is also provided extending between the right wall and the left wall. This horizontal brace is generally parallel to the platform. The walls are, preferably, substantially parallel to each other.

In an alternate preferred embodiment of the invention, a frame for securing in-line skate wheels to a skate boot is provided. The frame includes at least one mounting platform, a right wall, a left wall, and a first cross brace. The mounting platform is adapted for securing the skate boot thereto. The right wall and left wall extend downwardly from the mounting platform. Both walls include lower regions having apertures for securing the wheels thereto. The apertures of the walls are substantially aligned. In this embodiment, the first cross brace extends diagonally down from the mounting platform to one of the right wall and the left wall. The first cross brace has an upwardly facing surface, a downwardly facing surface, a forward edge, and a rearward edge. A lower end of the cross brace is attached to one of the walls and an upper end is attached to the mounting platform.

Another aspect of the invention also includes a method of making a skate frame for an in-line skate from a material. The method includes forcing the material through an orifice in a die and machining wheel wells within the material. The die has a cross-sectional orifice shape to form two walls, a first platform, a second platform and a diagonal cross brace in the material. The first platform extends between the two walls. The second platform extends between the two walls and below the first platform. The diagonal cross brace extends from a lower portion of one of the walls to one of the platform and the other of the walls. The wheel wells are machined within the cross brace.

BRIEF DESCRIPTION OF THE DRAWINGS

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:

FIG. **1** is a perspective view of a skate frame according to the present invention with a skate and wheels shown in phantom;

FIG. **2** is a perspective view of a skate frame having one of the walls of the frame cut away to view the cross braces;

FIG. **3** is a cross-sectional view of an extrusion before machining to construct the frame illustrated in FIGS. **1** and **2**;

FIG. **4** is an isometric view of the extrusion before being machined;

FIG. **5** is an end view of an extrusion for an alternate embodiment of the frame of the present invention including deeper cross braces;

FIG. **6** is an end view of an extrusion of second alternate embodiment of the frame of the present invention without a horizontal midbrace; and

FIG. **7** is an end view of an extrusion for a third alternate embodiment of a frame of the present invention having a single cross brace.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIGS. **1** and **2**, the first preferred embodiment of the frame of the present invention will be described. A skate **10** is provided that includes a boot **12**, a frame **14**, and wheels **16**. Boot **12** is connected beneath the heel and forward portion of the sole, in the area adjacent the ball of the foot, to the top of frame **14**. Boot **12** may be any type of skate boot or shoe such as for hockey, speed, or stunt skating. The sole of boot **12** may alternatively be integrally formed with frame **14**. Wheels **16** are rotatably connected to frame **14** with axles **18**. Wheels **16** are aligned in a row with parallel axles, one behind another.

Frame **14** is preferably constructed of extruded aluminum, as discussed below with regard to FIGS. **3** and **4**. Frame **14**, after being machined, includes a forward mounting platform **20**, a heel mounting platform **22**, a right wall **24**, and a left wall **26**. Forward mounting platform **20** is positioned at the top, forward end of frame **14** and includes a flat surface, onto which the forward end of the sole of boot **12** may be positioned and secured. Forward mounting apertures **28** extended through within forward mounting platform **20** for this purpose. Forward mounting apertures **28** are preferably elongated slots into which a fastener may be secured. The slots are oriented longitudinally such that boot **12** may be adjusted forwardly or rearwardly, as desired or to accommodate various sizes of boot **12**. In the preferred embodiment of the invention, forward mounting platform **20**, because it is extruded from the same piece of aluminum as entire frame **14**, is substantially horizontal and falls within a plane parallel to the longitudinal axis of frame **14**. Forward mounting platform **20** also includes flanges projecting outwardly from the tops of walls **24** and **26** for increased stability and secure mounting to the sole or base of boot **12**. The lateral side of the flange of forward mounting platform **20** outwardly extends further than the medial side.

Heel mounting platform **22** is positioned on top of right and left walls **24** and **26** at the rearward end of frame **14**. Heel mounting platform **22** is also integrally formed with walls **24** and **26** and forward mounting platform **20**. Heel mounting platform **22** is positioned slightly higher than forward mounting platform **20** to secure the heel of boot **12** slightly above the forward portion of the base of boot **12**. Heel mounting platform **22** also includes small flanges extending outwardly on the medial and lateral sides of walls **24** and **26**. Heel mounting platform **22** includes a heel mounting aperture **30** in the center thereof, for securing the heel boot **12** thereto. Heel mounting aperture **30** is an elongate slot through which a fastener may be secured to the heel of boot **12**. As with apertures **28**, the elongate slot allows for adjustability of boot **12** relative to frame **14** or for the accommodation of various boot base sizes.

The portion of the aluminum extrusion that creates forward mounting platform **20** also creates horizontal upper brace **32** directly below heel mounting platform **22**. These two elements are separated when frame **14** is machined. Horizontal upper brace **32** extends between walls **24** and **26** at the same level as forward mounting platform **20**. The portions of walls **24** and **26** between heel mounting platform **22** and forward mounting platform **20** include recesses such that platforms **20** and **22** are projected upwardly by those remaining portions of walls **24** and **26** located directly beneath platforms **20** and **22**. The upper edges of walls **24** and **26** between platforms **20** and **22** are parallel to the bottom edges of walls **24** and **26**.

Axle apertures **34** are provided in equally spaced relationship along a lower portion or region of walls **24** and **26** to secure wheels **16** on axles **18**. The insides of walls **24** and **26**, adjacent axle apertures **34**, project inwardly to provide integrally formed spacers **35**. Frame spacers **35** space the outer races of the bearings of wheels **16** from walls **24** and **26** so the outer races can rotate freely even with high lateral loads on wheels **16**.

Due to the lateral loads that may be encountered while skating, especially with hockey skating, frame **14** is provided with several braces between walls **24** and **26**. FIG. **2** illustrates several preferred locations for these braces. To understand more completely the make-up and construction of the braces discussed below, reference should also be had to FIGS. **3** and **4**. FIG. **4** illustrates an extrusion of aluminum that is used to create the frame illustrated in FIGS. **1** and **2**. FIG. **3** is an end view of the extrusion illustrated in FIG. **4**. The aluminum is extruded and then machined to create the recesses, wheel wells, apertures, and other features that result in the final frame illustrated in FIGS. **1** and **2**. In the preferred embodiment of the invention, a four-wheeled skate is provided. Therefore, this results in three sets of cross braces, one set between each couple of wheels. Hence, common numbers with differing letters (a, b, and c) will be used to designate common cross members created during the extrusion. Note that other fabrication methods, such as pultrusion, could also be used. In FIGS. **3** and **4**, the numbers without letters are used since the wheel wells have not been cut between the three final sets of cross braces.

First, a horizontal midbrace is provided that extends between the midportions of walls **24** and **26**. After machining wheel wells, horizontal midbrace **36** results in a forward portion **36***a*, a middle portion **36***b*, and a rearward portion **36***c*. The forward and rearward sides of horizontal midbraces **36** are concave for close fitting with wheels **16** and to provide additional strength in their connections with walls **24** and **26**. Horizontal midbrace **36** provides impact resistance to frame **14** and maintains the spacing between walls **24** and **26** while skating. The shape created by horizontal midbrace **36** combined with forward mounting platform **20**, upper horizontal brace **32** and heel mounting platform **22** is rectangular. Consequently, this brace is not as efficient in countering extreme lateral loads and moments created by wheels **16** when a skater is cornering or stopping, or even thrusting the skate out to the side.

First cross brace **38** and second cross brace **40** are more efficient to counter the forces created during skating. First cross brace **38** extends from an upper portion of right wall **24** to a lower portion of left wall **26** diagonally downward. First cross brace **38** lies within a plane substantially parallel to the longitudinal axis of frame **14**. Similar to horizontal midbrace **36**, first cross brace **38** includes a forward portion **38***a*, a middle portion **38***b*, and a rearward portion **38***c*. These various portions are created after machining the wheel wells as well as the wall recesses of frame **14**, as described above. In the embodiment illustrated in FIG. **2**, the lower portions of forward and rearward portions **38***a* and **38***c*, have also been removed. This leaves only upper sections **38***a* extending from right wall **24** down to their intersection with horizontal midbrace forward portion **36***a* and rearward portion **36***c*. However, in alternate preferred embodiments, first cross brace forward and rearward portions **38***a* and **38***c* extend downwardly to an attachment with left wall **26**. Alternatively, since frame **14** is integrally formed, a cross brace is effectively created by forward portion **38***a* of first cross brace **38** and the left side portion of horizontal midbrace forward portion **36***a*. In this manner, the walls are effectively interconnected with cross bracing and also with cross bracing provided by second cross brace **40**.

Second cross brace **40** also includes forward, middle, and rearward portions **40***a*–**40***c*. These portions are mirror images of first cross brace portions **38***a*–**38***c*, extending from left wall **26**. In this manner, substantial strength is provided to frame **14** such that walls **24** and **26**, at their connections to wheel **16**, are rigid and difficult to deflect. Thus, the skater's energy and control during quick and forceful cornering, thrusting, and stopping maneuvers is efficiently and effectively maintained and transferred from the skater's foot to the wheels of skate **10**. Minimal energy is lost by any frame flexing due to the stiff frame created by such cross bracing.

As illustrated in FIGS. **3** and **4** and as briefly discussed above, the frame is created preferably by extrusion of aluminum. However, pultrusion or extrusion of other materials may also be used to create a frame with cross bracing as described above. Aluminum is extruded through a die and then machined with recesses, wheel wells, and other apertures and curves to create a frame such as that illustrated in FIGS. **1** and **2**.

Alternative cross bracing constructions are also encompassed by the present invention. For example, FIG. **5** illustrates an alternate preferred extrusion of a frame **114**. The numbering in FIG. **5** corresponds to that of the previous figures except that **100** has been added to each two digit number that generally corresponds to elements of FIGS. **1** through **4**. Thus, frame **114** is provided with right and left walls **124** and **126**, forward platform **120**, and rearward platform **122**. A horizontal upper brace **132** is provided as a rearward extension of forward mounting platform **120**. In this embodiment, first cross brace **138** extends from right wall **124** by being connected thereto with horizontal upper brace **132**. First cross brace **138** extends downwardly much lower than the cross braces illustrated in FIGS. **1** through **4** and described above. First cross brace **138** extends to a lower region of left wall **126** between axle apertures. Likewise, second cross brace **140** extends from horizontal upper brace **132**, down to a lower region of right wall **124** to be connected at a position in substantial alignment with axle apertures. Thus, cross braces **138** and **140** provide superior leverage to counteract lateral forces and moments generated by wheels **16**. Note that several triangles are created by horizontal midbrace and first and second cross braces **136**, **138** and **140**. These triangles contribute to the strength of frame **114**. Also note that a triangle is effectively created between axle **118** and the lower portions of first and second cross braces **138** and **140**. These triangles are created with cross braces that are quite wide in the longitudinal direction and lie within planes parallel to the longitudinal axis of frame **14**. These are the most efficient planes to lie within for counteracting lateral the forces involved in skating. Thus, the structural efficiency of frame **114** is extremely high.

FIG. **6** illustrates another alternate embodiment of a frame **214**. Frame **214** is very similar to the embodiment illustrated in FIG. **5**. Again, like digits are used to number the elements in FIG. **6** except, in this case **200** has been added to each original two digit number to differentiate this embodiment. This embodiment is very similar to FIG. **5** except that horizontal midbrace **136** has been omitted. This would result in a slightly lighter weight skate frame **214**. However, triangles are still created with first and second cross braces **238** and **240**, intersecting at their midpoints to provide support for one another.

FIG. **7** illustrates a third alternate embodiment with frame **314** (**300** being added to each reference number). Frame **314** includes a single cross brace **338** extending from approximately the intersection of horizontal upper brace **332** with right wall **324** down to the lower region of left wall **326** between axle apertures. Strong triangles are also created with this embodiment. One triangle is created between cross brace **338**, horizontal upper brace **332**, and left wall **326**. A second triangle is effectively created between cross brace **338**, axle **318**, and right wall **324**. Thus, while minimal material is ultimately used to provide cross bracing, significant strength is still gained.

While the preferred embodiments of the invention have been illustrated and described, it will be appreciated that various changes can be made therein without departing from the spirit and scope of the invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A frame for securing in-line skate wheels to a skate boot, the frame having a longitudinal axis, the frame comprising:

(a) at least one mounting platform adapted for securing the skate boot thereto;

(b) a right wall extending downwardly from said mounting platform and including a lower region having apertures for securing the wheels thereto;

(c) a left wall extending downwardly from said mounting platform and including a lower region having apertures for securing the wheels thereto, the apertures of said walls being substantially aligned; and

(d) a first cross brace having a major plane defining a downward facing surface, the downward facing surface extending diagonally down from one of said right wall and said left wall to the other of said right wall and said left wall, said first cross brace also having an upward facing surface, a forward edge, a rearward edge, a lower end attached to one of said walls and an upper end attached to the other of said walls.

2. The frame of claim **1**, wherein said first cross brace extends substantially along a plane substantially parallel to the longitudinal axis of the frame.

3. A frame for securing in-line skate wheels to a skate boot, the frame having a longitudinal axis, the frame comprising:

(a) at least one mounting platform adapted for securing the skate boot thereto;

(b) a right wall extending downwardly from said mounting platform and including a lower region having apertures for securing the wheels thereto;

(c) a left wall extending downwardly from said mounting platform and including a lower region having apertures for securing the wheels thereto, the apertures of said walls being substantially aligned; and

(d) a first cross brace extending diagonally down from one of said right wall and said left wall to the other of said right wall and said left wall, said first cross brace having an upward facing surface, a downward facing surface, a forward edge, a rearward edge, a lower end attached to one of said walls and an upper end attached to the other of said walls, wherein said first cross brace extends substantially along a plane substantially parallel to the longitudinal axis of the frame, further comprising a second cross brace extending substantially along a plane substantially parallel to the longitudinal axis of the frame and substantially transverse to said first cross brace, said second brace extending from an upper portion of one of said walls to a lower portion of the other of said walls.

4. The frame of claim **3**, further comprising a horizontal brace extending between said right wall and said left wall, said horizontal brace being generally parallel to said platform.

5. The frame of claim **2**, wherein said lower end of said first cross brace is attached to the lower region of one of said walls.

6. A frame for securing in-line skate wheels to a skate boot, the frame having a longitudinal axis, the frame comprising:

(a) at least one mounting platform adapted for securing the skate boot thereto,

(b) a right wall extending downwardly from said mounting platform and including a lower region having apertures for securing the wheels thereto;

(c) a left wall extending downwardly from said mounting platform and including a lower region having apertures for securing the wheels thereto, the apertures of said walls being substantially aligned; and

(d) a first cross brace extending diagonally down from one of said right wall and said left wall to the other of said right wall and said left wall, said first cross brace having an upward facing surface, a downward facing surface, a forward edge, a rearward edge, a lower end attached to one of said walls and an upper end attached to the other of said walls, wherein said lower end of said first cross brace is attached to the lower region of one of said walls, further comprising a second cross brace extending substantially along a plane substantially parallel to the longitudinal axis of the frame and substantially transverse to said first cross brace, said second brace extending from an upper portion of one of said walls to a lower portion of the other of said walls.

7. The frame of claim **6**, further comprising a horizontal brace extending between said right wall and said left wall, said horizontal brace being generally parallel to said platform.

8. The frame of claim **2**, wherein a transverse cross section of said first cross brace, combined with a transverse cross section of one of said right and left walls and a transverse cross section of said platform, substantially forms a triangular shape.

9. The frame of claim **8**, wherein said first cross brace is attached to one of said walls between two of the apertures such that said first cross brace is between two wheels when the wheels are secured to the frame.

10. The frame of claim **1**, wherein said walls are substantially parallel.

11. The frame of claim **10**, wherein said first cross brace extends substantially along a plane substantially parallel to the longitudinal axis of the frame.

12. The frame of claim **11**, wherein a transverse cross section of said first cross brace, combined with a transverse cross section of one of said right and left walls, and a transverse cross section of said platform, substantially forms a triangular shape.

13. A frame for securing in-line skate wheels to a skate boot, the frame having a longitudinal axis, the frame comprising:

(a) at least one mounting platform adapted for securing the skate boot thereto;

(b) a right wall extending downwardly from said mounting platform and including a lower region having apertures for securing the wheels thereto;

(c) a left wall extending downwardly from said mounting platform and including a lower region having apertures for securing the wheels thereto, the apertures of said walls being substantially aligned; and

(d) a first cross brace disposed between the right and left walls extending diagonally down from said mounting platform to one of said right wall and said left wall, said first cross brace having an upward facing surface, a downward facing surface, a forward edge, a rearward edge, a lower end attached to one of said walls and an upper end attached to said mounting platform.

14. The frame of claim **13**, wherein said first cross brace extends substantially along a plane substantially parallel to the longitudinal axis of the frame.

15. The frame of claim **14**, wherein said lower end of said first cross brace is attached to the lower region of one of said walls.

16. The frame of claim **15**, further comprising a second cross brace extending substantially along a plane substantially parallel to the longitudinal axis of the frame and substantially transverse to said first cross brace, said second brace extending from said mounting platform to a lower portion of one of said walls.

17. The frame of claim **16**, further comprising a horizontal brace extending between said right wall and said left wall, said horizontal brace being generally parallel to said platform.

18. The frame of claim **14**, wherein a transverse cross section of said first cross brace combined with a transverse cross section of one of said right and left walls and a transverse cross section of said platform substantially forms a triangular shape.

19. The frame of claim **18**, further comprising a second cross brace extending substantially along a plane substantially parallel to the longitudinal axis of the frame and substantially transverse to said first cross brace, said second brace extending from said mounting platform to a lower portion of one of said walls.

20. The frame of claim **19**, wherein said walls are substantially parallel.

21. A frame for securing in-line skate wheels to a skate boot, the frame having a longitudinal axis, the frame comprising:

(a) at least one mounting platform adapted for securing the skate boot thereto;

(b) a right wall extending downwardly from said mounting platform and including a lower region having apertures for securing the wheels thereto;

(c) a left wall extending downwardly from said mounting platform and including a lower region having apertures for securing the wheels thereto, the apertures of said walls being substantially aligned; and

(d) a first cross brace extending diagonally down from said mounting platform to one of said right wall and said left wall, said first cross brace having an upward facing surface, a downward facing surface, a forward edge, a rearward edge, a lower end attached to one of said walls and an upper end attached to said mounting platform, wherein said first cross brace extends substantially along a plane substantially parallel to the longitudinal axis of the frame, wherein said first cross brace is attached to one of said walls between two of the apertures such that said first cross brace is between two wheels when the wheels are secured to the frame.

22. A method of making a skate frame for an in-line skate from a ductile material, the method comprising:

(a) forcing the material through a die having a cross-sectional shape to form two walls, a first platform extending between the two walls, a second platform extending between the two walls below said first platform, and a diagonal cross brace extending from a lower portion of one of the walls to one of the platform and the other of the walls; and

(b) machining wheel wells within the cross brace.

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