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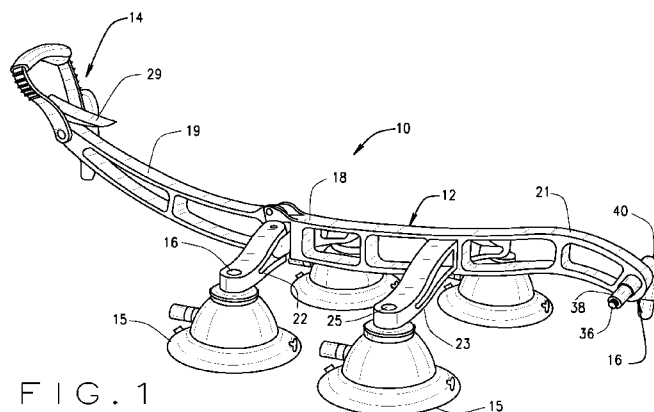


FIG. 1

(57) Abstract: A carrier system (10) for a vehicle having a pair of vacuum devices (16) shaped and sized to mate and secure to a recreational article. Each vacuum device (16) includes a pad (54) shaped and sized to detachably seat with a vehicle to form a vacuum cavity. The vacuum device (16) includes a plunger (42) attached to the pad (16) and in fluid communication with the vacuum cavity, and an indicator positioned on the plunger (42) to indicate the level of vacuum pressure within the vacuum cavity.

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VACUUM MOUNTED CARRIER FOR A VEHICLE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to United States Provisional
5 Application No. 62/218,940 filed September 15, 2015 entitled VACUUM
MOUNTED CARRIER FOR A VEHICLE and which is incorporated herein
by reference.

BACKGROUND ART

The present disclosure relates to a system that detachably
10 installs to automotive vehicles for transporting articles without
compromising, but instead maintaining the integrity of a mounting
surface, and more particularly, to a carrier system that detachably
installs to vehicles with a vacuum assembly for transporting articles.

Carriers or racks are commonly used with automotive vehicles to
15 transport various recreational equipment, such as, bicycles, skis,
snowboards, surfboards, and the like. Conventional carriers are
mounted in one of these locations: to the roof, to the trunk, the rear
window, to the truck bed, or to a trailer hitch. To withstand the large
forces on the carrier and the supported articles while the vehicle is
20 moving, conventional carriers must securely attach to the vehicle. Either
the carrier is permanently attached to the vehicle with fasteners, or
removeably attached to the vehicle using brackets, straps, or latches.
However, both methods have disadvantages.

Permanently installed carriers can be expensive to purchase and
25 install, and typically require modifications to the vehicle. In addition,
they cannot be removed. Detachable carriers are difficult and time-
consuming to install and must be repeatedly installed and removed.
Also, they are susceptible to damaging the vehicle during installation
and use due to the plates and straps applied to the vehicle under

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tension which causes denting and scratching. If improperly installed, damage can occur to the vehicle and the articles being transported.

Typically, conventional racks are designed for use with a specific make and model of vehicle. Therefore, consumers cannot use a single
5 rack for multiple vehicles, at least not without adaptors or modifications. As a result, manufacturers must produce an increased number of parts, and retailers must provide an ever increasingly complex list of parts options lists to consumers, which also increases the cost.

There is a long felt need in the marketplace for a bike rack that is
10 compatible with sports cars and other vehicles that have very limited space available for attachment. For example, convertible vehicles typically only have a small rear trunk area available for attachment. Therefore, a carrier that is easily and reliably installed and removed from a multiple vehicles including vehicles with small attachment footprints is
15 needed that maintains the integrity of a mounting surface.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings which form part of the specification:

- 20 Figure 1 is a perspective view of a carrier system;
Figure 2 is an overhead view of the carrier system;
Figure 3 is a perspective view of the carrier system in a collapsed position;
Figure 4 is an overhead view of the carrier system in an
25 articulated position;
Figure 5 is a is a rear perspective view of the carrier system mounted to a vehicle;
Figure 6 is a perspective view of the carrier system mounted to the vehicle;
30 Figure 7 is a perspective view of a rear fork;

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Figure 8 is a perspective view of a rear fork with end cap removed;

Figure 9 is a perspective view of a rear fork with rear wheel mount;

5 Figure 10 is a perspective view of a rear fork with a rear wheel coupled to the rear wheel mount; and

Figure 11 is an exploded view of a vacuum device;

Figure 12 is a perspective view of a bicycle secured to a vehicle with a locking system;

10 Figure 13 is a perspective view of the locking clip engaged with a vehicle window.

Corresponding reference numerals indicate corresponding parts throughout the several figures of the drawings.

BEST MODES FOR CARRYING OUT THE INVENTION

15 The following detailed description illustrates the claimed invention by way of example and not by way of limitation. The description clearly enables one skilled in the art to make and use the disclosure, describes several embodiments, adaptations, variations, alternatives, and uses of the disclosure, including what is presently believed to be the best mode
20 of carrying out the claimed invention. Additionally, it is to be understood that the disclosure is not limited in its application to the details of construction and the arrangements of components set forth in the following description or illustrated in the drawings. The disclosure is capable of other embodiments and of being practiced or being carried
25 out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting.

As shown in Figures 1-13, an embodiment of the present disclosure, generally referred to as a carrier system 10, includes a frame
30 member 12 with first and second mounts 14 and 16 that are sized and shaped to couple with recreational articles, and a plurality of vacuum

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devices 16 attached to the frame member 12 that can detachably attached to a mounting surface 17 of a vehicle. The carrier system 10 can couple with any recreational article, including, but not limited to, a bicycle, skis, a snowboard, a surfboard, a canoe, or a kayak.

5 The frame 12 is a generally arcuate support bar 18 with a front member 19 pivotally connected to a rear member 21, such as with fasteners so that the front member 19 can pivot from an operating position (Fig. 1) to a storage position (Fig. 3). The front member 19 of the support bar 18 curves generally upward terminating in the first
10 mount 14, and the rear member 21 curves generally downward terminating with the second mount 16.

 A front crossbar 22 and rear crossbar 23 extend generally perpendicularly from the rear member 21 of the support bar 18. Respective ends 22 of the crossbars 22 and 23 are each sized and
15 shaped to mate with respective vacuum devices 16, such as with fasteners 25. Those skilled in the art will recognize that the crossbars 22 and 23 can be any shape and size capable of mating with the vacuum device 16. The rear crossbar 21 includes left and right portions that pivotally attach to the support bar 18 to accommodate undulating
20 surfaces such as sharp curves or bumps on the vehicle.

 In the embodiment of Figs. 1-4, the frame 12 mates with four vacuum devices 16, such as with fasteners 13, to provide enough vacuum strength to withstand the tensions, shear, and other forces on the carrier system 10 during operation. Multiple vacuum devices 16 help
25 stabilize the load and provide redundancy should one or more vacuum device 16 fail.

 The first mount 14 includes an arcuate support member 29 sized and shaped to receive a bicycle tire and a securement strap 31 to secure the tire to the support member 29. However, the first mount 14
30 can be configured to secure other portions of the bicycle or other recreational articles. In addition, the first mount can comprise other types of securing devices, such as a bicycle skewer assembly.

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The second mount 16 is a skewer assembly 28 sized and shaped to couple with front or rear fork arms 35 of a bicycle 37. The skewer assembly 28 includes a generally tubular housing 30 that defines a bore 32 along a center axis A-A. (Fig. 1). Generally cylindrical protrusions 34
5 extend outwardly from each end of the housing 30 along the axis A-A. The protrusions 34 are shaped and sized to mate with the front clevises 36 of the fork arms, which first requires removal of the wheel. To secure the fork arms 35 to the skewer assembly 28, a skewer rod 36 inserts through the bore 32 and secures with a fasteners, such as a nut 38 and
10 a cam clamp 40. The cam clamp 40 can be tightened or loosened to secure and release the fork. Those skilled in the art will recognize that the mount 14 can include any other suitable arrangement that properly secures a recreational article, such as, straps, fasteners, clamps, cables, brackets, tethers, and the like. In addition, the mount 14 can
15 include adaptors that accommodate various fork sizes and models, such as "Fork Up" available from Hurricane Components for 15mm or 20mm through-axle models. Also, the rear wheel of the bicycle 37 can be cradled in the rack instead of the front fork so that the front wheel does not need to be removed.

20 The vacuum devices 16 are similar to the device disclosed in U.S. patent publication No. 2007/0216154, which is hereby incorporated by reference. Each vacuum device 16 includes a vacuum pad 42 and an attached vacuum pump 44 (Fig. 3). A housing 46 attaches to the vacuum pad 42 to enclose and secure the vacuum pump 44 to the
25 vacuum pad 42. The housing is 46 shaped and sized to enclose the vacuum pump 44 while allowing for the attachment of an accessory and likewise to a surface of a vehicle.

The vacuum pad 42 is generally a conical frustum that defines a top face 48 having threaded holes 50 to mount with the housing 46
30 using fasteners 52. The vacuum pad 42 also includes a recessed vacuum face 54 being generally parallel to the top face 48, a sloped side surface 56 extending between the top face 48 and the vacuum face 54,

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and a generally circumferential seating edge 58 along the perimeter of the vacuum face 54. In this arrangement, the seating edge 58 can seat with the mounting surface 17 of a vehicle to form a vacuum cavity 60. The vacuum pad 42 defines a channel 62 extending from the top face 48 to the vacuum face 54 and sized to mate with the vacuum pump 44. Release tabs 64 extend outwardly from the side surface 56. The release tabs 64 are generally t-shaped ribs that are shaped and sized to enhance rigidity of the pad 42 and help prevent release of the vacuum device 16 from the mounting surface 17, such as during exposure to warmer temperatures.

Preferably, the pad 42 is made from a flexible material, such as, rubber, or plastic. However, the pad 42 can comprise any material that allows the vacuum pad 42 to seat with the mounting surface 17. Preferably, the material should not be prone to scuffing the mounting surface during installation or operation. In addition, the material can comprise any suitable color and may include other desirable attributes. For example, the pad 42 can be a reflective or glow-in-the-dark material so that it can be seen in dark environments.

The pump 44 includes a generally cylindrical plunger 66 and a hollow cylinder 68 that defines a chamber 70 sized and shaped to receive the plunger 66. The plunger 66 moves within the chamber 70 between a pressed position and a released position to create the vacuum cavity 60 between the vacuum face 54 and the mounting surface 17. The cylinder 68 has an opening to the chamber 70 at one end and is closed at the opposite end. A tube 72 extends generally perpendicularly from the closed end of the cylinder 68. The tube 72 is sized and shaped to insert into the channel 62 of the vacuum pad 42 to provide fluid communication between the cylinder chamber 70 and the vacuum cavity 60. The plunger 66 is sized to insert into the cylinder 68 with a sliding fit that allows the plunger 66 to move back and forth within the cylinder 68. A check valve 74 is positioned within the cylinder chamber 70 in communication with the chamber 70 and the tube 72 so

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that fluids and gases can only transfer into the tube 72 from outside of the cylinder 68. This allows the vacuum device 16 to be re-pumped without loss of remaining vacuum. In an alternate embodiment, an automatic pump can be used to increase the vacuum level of the vacuum device if it falls below a pre-determined level. In another alternate embodiment, a vacuum device includes a signaling component capable of indicating or sending a signal that indicates a loss of a designated amount of pressure, including, but not limited to, an audio signal, a visual signal, an electronic signal, or a wireless or Bluetooth® signal. For instance, a signaling component can send a wireless signal to a wireless phone and, in conjunction with appropriate software on the phone, indicate the vacuum pressure.

The plunger 66 is generally a rod with a push button 76 at one end, a seal 78 at the opposite end, and a biasing member 80 therebetween. The seal 78 is sized and shaped to seat against the inner wall of the cylinder 68. When the plunger 66 inserts into the cylinder chamber 70, the biasing member 80 biases the plunger 66 to the released position. The position of the plunger 66 in the released position will vary respective to the amount of vacuum pressure within the vacuum cavity 60.

An indicator 82 positioned about the lower portion of the push button 76 indicates to the operator the relative amount of vacuum pressure within the vacuum cavity 60. The indicator 82 is a colored ring or sleeve sized and shaped to attach around the lower portion of the push button 76. The indicator 82 can be red, yellow or any color that is easily seen. Additionally, the indicator 82 can be a reflective or glow-in-the-dark material so that it can be seen in dark atmospheres and under water. When no vacuum pressure exists in the vacuum cavity 60, the biasing member 80 extends the plunger 66 to its most extended release position. In this position, the indicator 82 is fully visible. As the pressure increases in the vacuum cavity 60, the force of the vacuum lessens the

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bias of the biasing member 80, and, in turn, the plunger 66 extends less from the chamber 70 and less of the indicator 82 is visible.

The housing 46 is a generally cylindrical member with a generally rectangular base which includes a top surface 84, bottom surface 86, first side 88, second side 90, third side 92, and pump side 94 (Fig. 3). The bottom surface 86 of the housing 46 defines housing apertures 96 for attachment to the vacuum pad 42 with fasteners. The top surface 84 defines attachment apertures 98 for attachment of accessories with appropriate means, such as fasteners, straps, and other suitable members. Although, housing apertures 96 and attachment apertures 98 are shown on top side 84 of housing 46, those skilled in the art will recognize that housing apertures 96 and attachment apertures 98 can be located on any side 88, 90, 92, 94 of the housing 46. Also, the housing apertures 96 and attachment apertures 98 can be holes, slots, or any other configuration sized and shaped to accommodate different dimensions of various manufacturers' accessories. The housing 46 can be made from a variety of materials, including marine grade stainless steel, powder-coated aluminum, rubber or plastic.

In operation, an operator places the vacuum face 54 of pad 42 against a mounting surface 17 of a vehicle, which creates a vacuum cavity 60 between the vacuum face 54 of the pad 42 and mounting surface 17. This embodiment is preferably used with a pick-up truck, with the mounting surface comprising the rear window of the truck. The operator repeatedly pushes the plunger 44 from the released position to the pressed position to remove fluid (air, gas, and/or water) from the vacuum cavity 60, thereby, reducing the pressure below the pressure the surrounding atmospheric pressure. This creates a vacuum such that edge 58 and vacuum face 54 of pad 42 seat against the mounting surface 17. A vacuum exists whenever the pressure within the space is less than the pressure that surrounds it. To obtain an adequate vacuum for operation, the operator should repeatedly press the plunger 66 until the indicator 82 is no longer visible when the plunger 66 is in the

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released position. If at any time during operation the indicator 82 becomes visible indicating a loss of vacuum, the operator can again repeatedly push the plunger 66 until the indicator 82 is no longer visible.

Once the carrier system 10 is attached to a mounting surface of a vehicle, a recreational device, such as a bicycle can be attached to the mount 14. In Figs. 1-3, the clevises of the fork arms 35 mate with the protrusions 34 and are secured by inserting and tightening a skewer rod 36. In this position, the rear bicycle wheel rests on the truck bed. When desired, the skewer rod 36 is loosened and the bicycle 37 can be removed.

To release the vacuum and remove the carrier system 10, the operator lifts the release tabs 64 on the side face 56 of pad 42 away from the mounting surface 17. In other embodiments, a valve stem can be activated to release the vacuum device 16. Additionally, a twist button with a coarse thread located on the top face of the pad 42 can be used to release the vacuum device 16.

As shown in Figs. 3-8, the carrier system 10 can also include a rear wheel mount 91 for securing the rear wheel of a bicycle 37 while the front of the bicycle 37 is secured to the mount 14. The rear wheel mount 91 is generally cylindrical member having an a first attachment portion that couples with a spindle of the rear wheel, such as with an internally threaded portion, and a second attachment portion that couples with a spindle of the front wheel. The second attachment portion 93 is generally a slotted disc that is configured to correspond to the front fork of the bike.

If desired, an attachment member 1500, such as a tether, rope, cord, cable, or other member, along with a lock 1502, can attach between the frame 12 and the vehicle, preferably with a security clip 1504, which is described in more detail below. When secured to the vehicle, the attachment member 1500 acts as a theft deterrent. Preferably, the frame 12 is constructed from a material capable of

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handling the loads and tensions occurring during operation of the carrier system, such as metal, fiberglass, plastic, or other suitable materials.

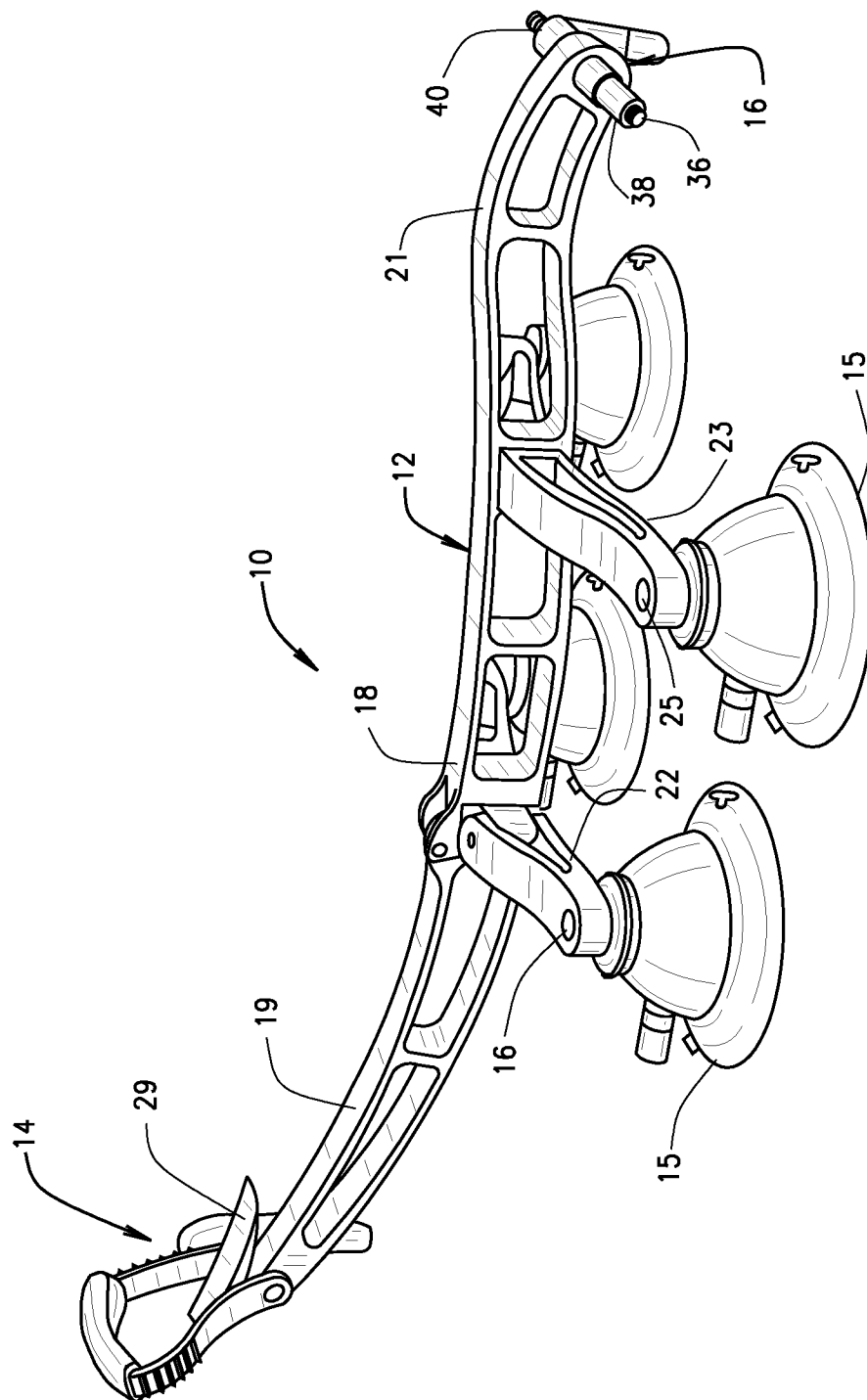
In all of the embodiments, the frames are preferably made from a lightweight metal, such as aluminum. However, any suitable material
5 can be used, including, but not limited to, steel, plastic, or composite material. Alternatively, the frame can be composed of a flexible material, such as Starboard® polymer material or other plastic..

Changes can be made in the above constructions without departing from the scope of the disclosure, it is intended that all matter
10 contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

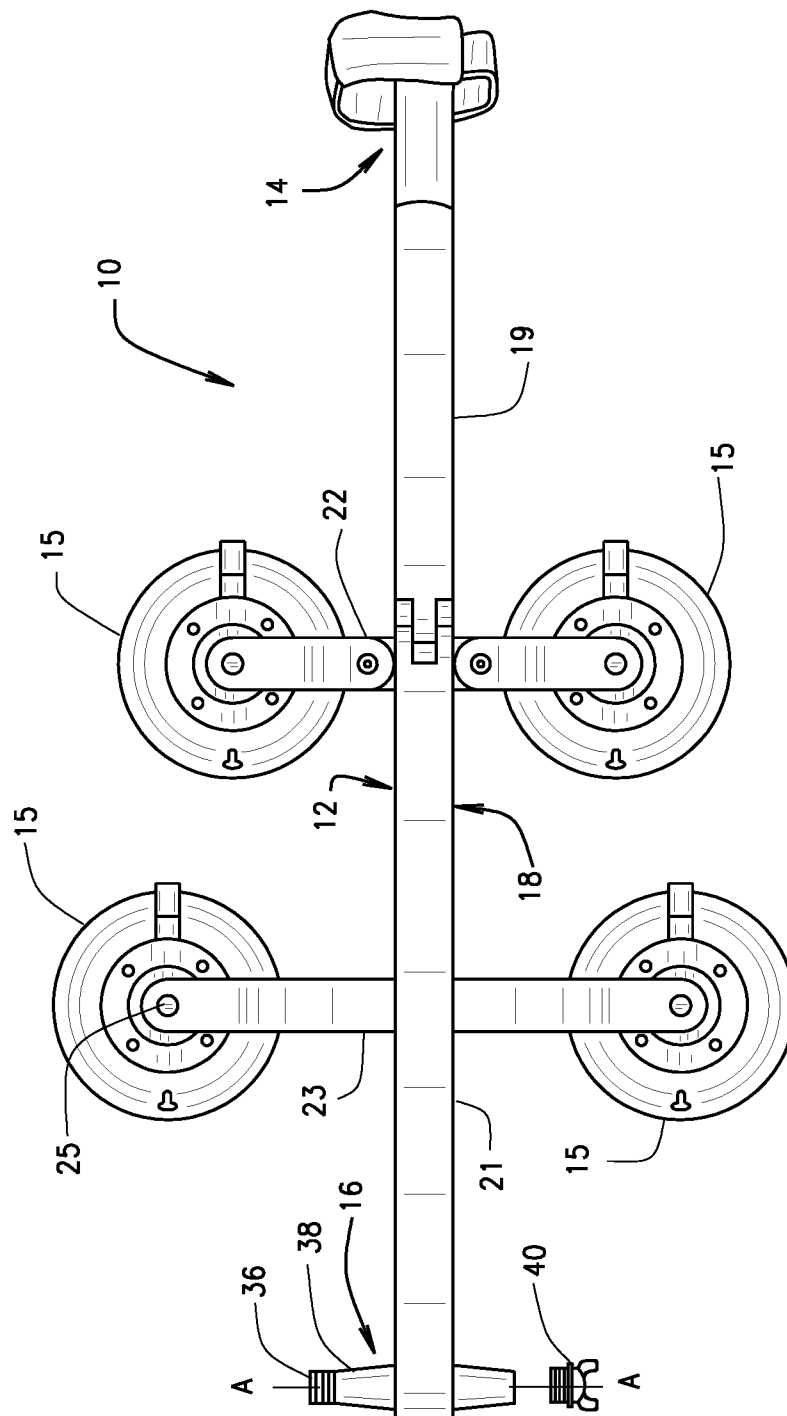
- 11 -

CLAIMS:

1. A carrier system for a vehicle, comprising:
 - a frame being shaped and sized to mate and secure a recreational article; and
 - a vacuum device having a pad shaped and sized to removeably seat with a vehicle to form a vacuum cavity, a plunger attached to the pad and in fluid communication with the vacuum cavity, and an indicator positioned on the plunger to indicate the level of vacuum pressure within the vacuum cavity.



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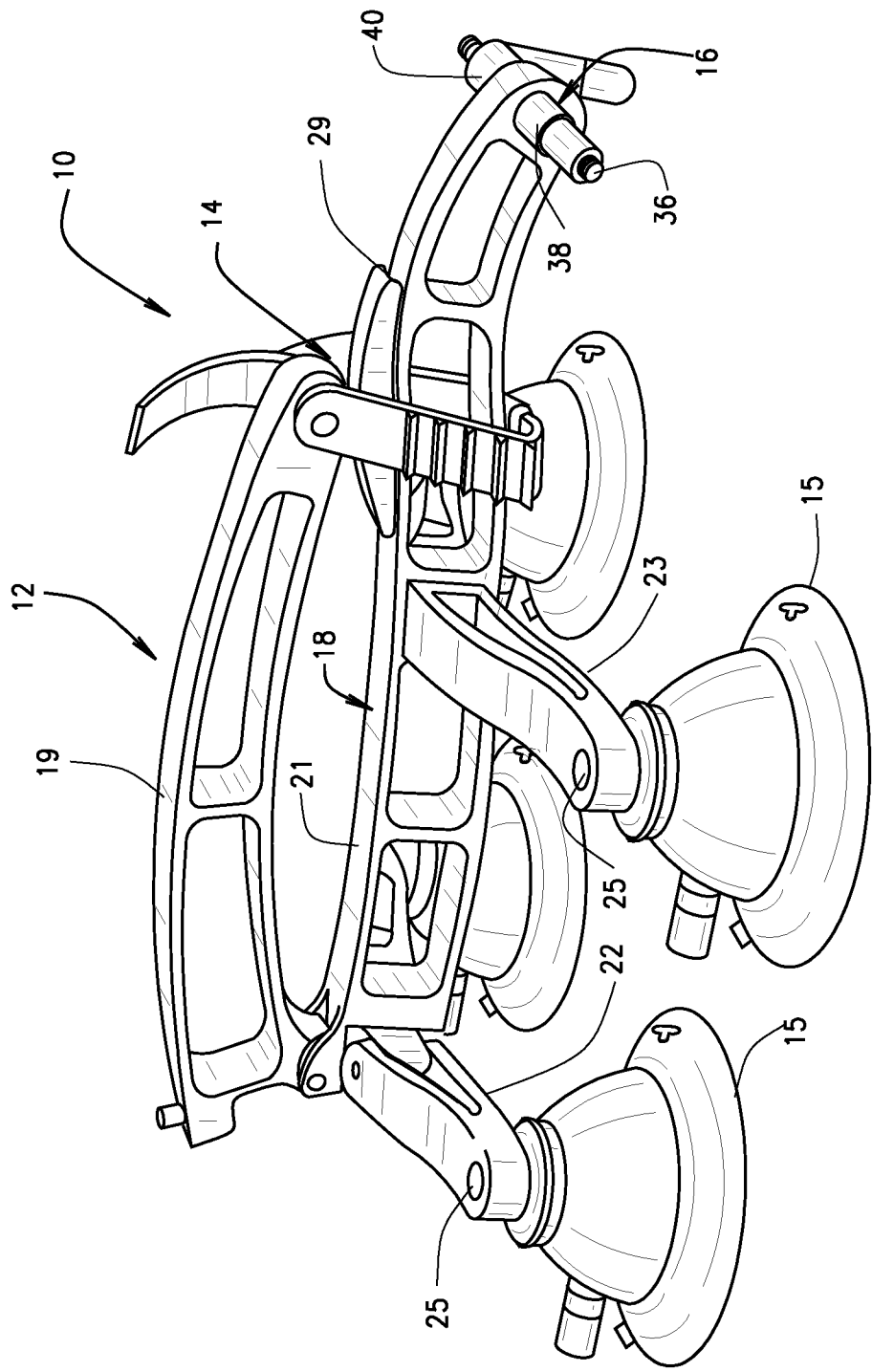


FIG. 3

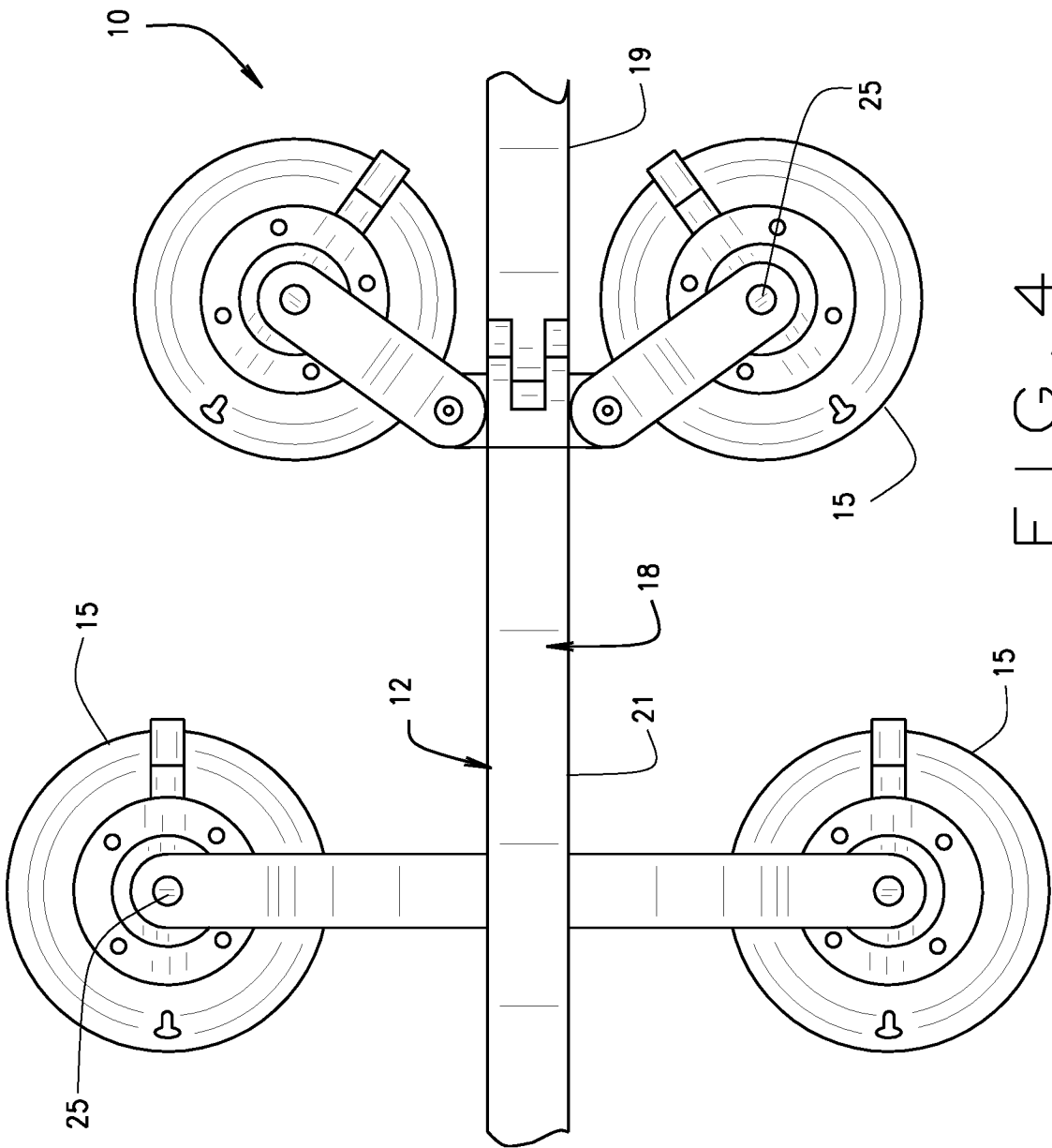


FIG. 4

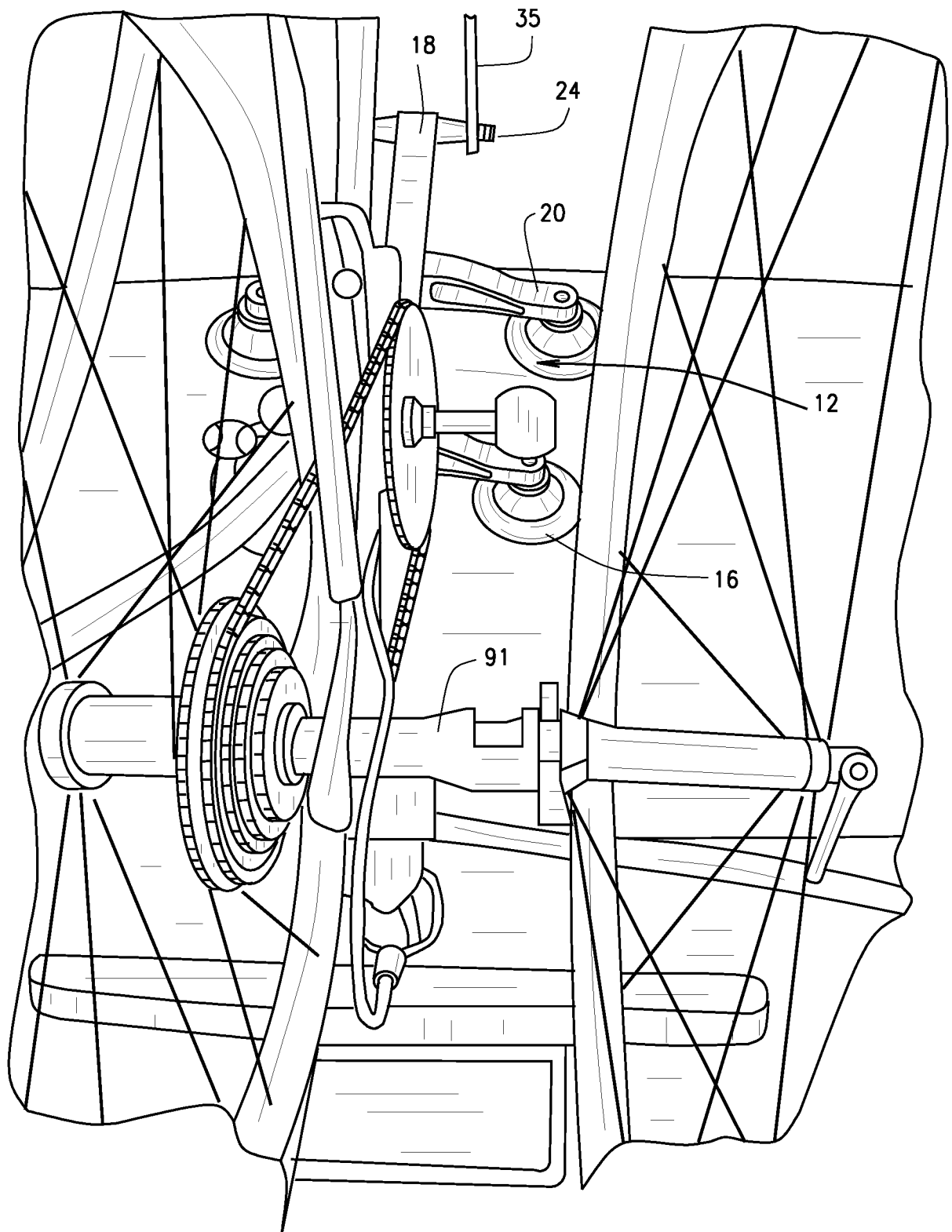


FIG. 5

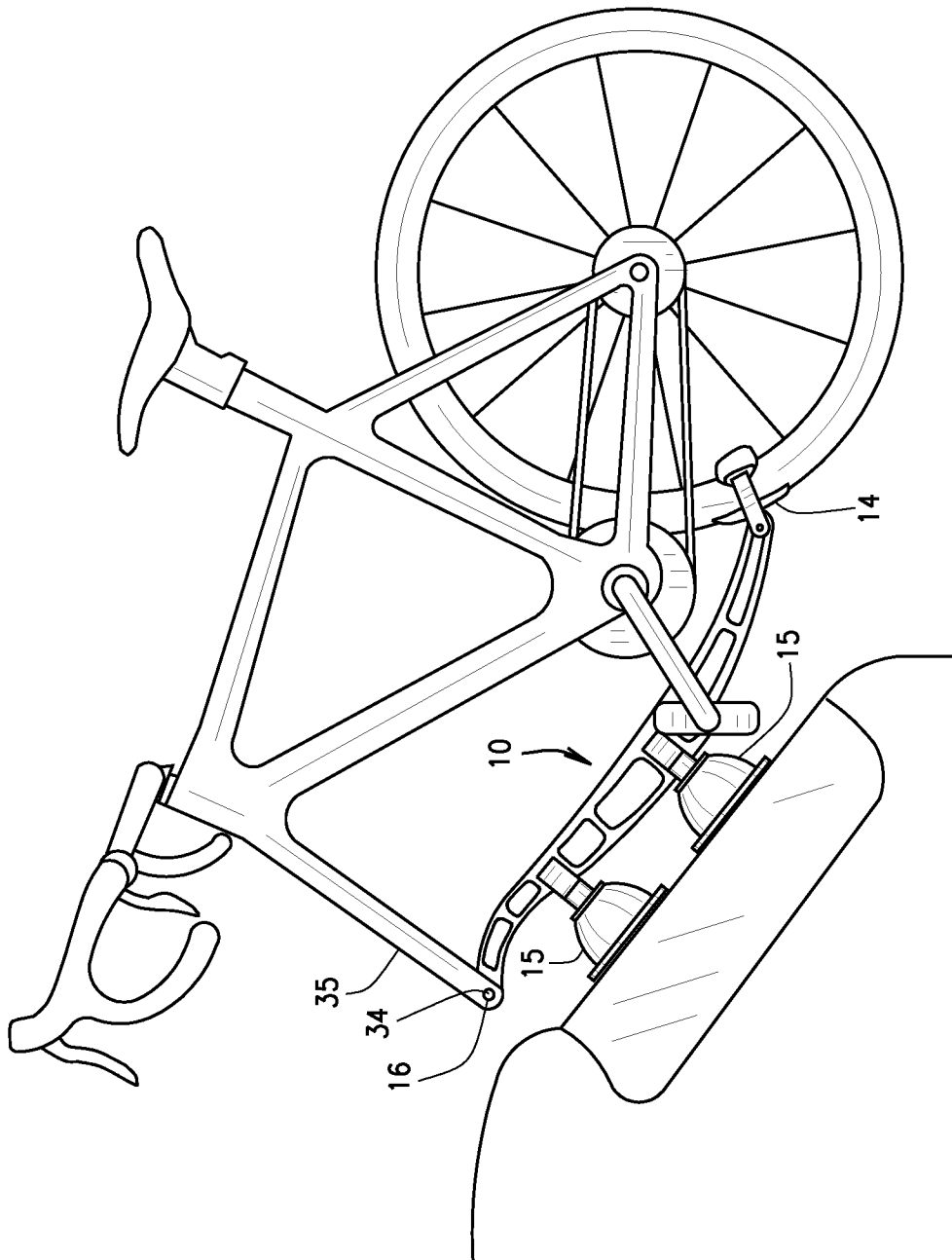


FIG. 6

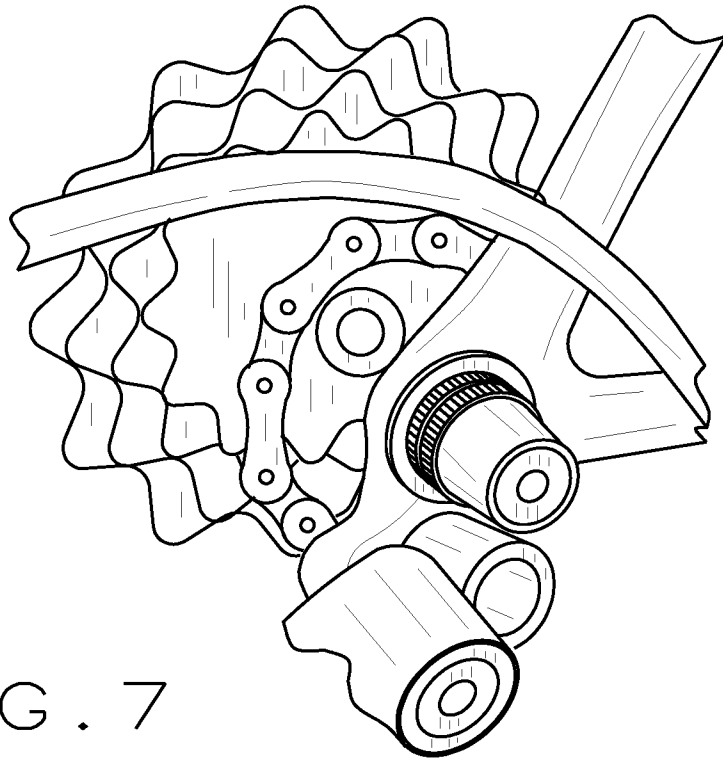


FIG. 7

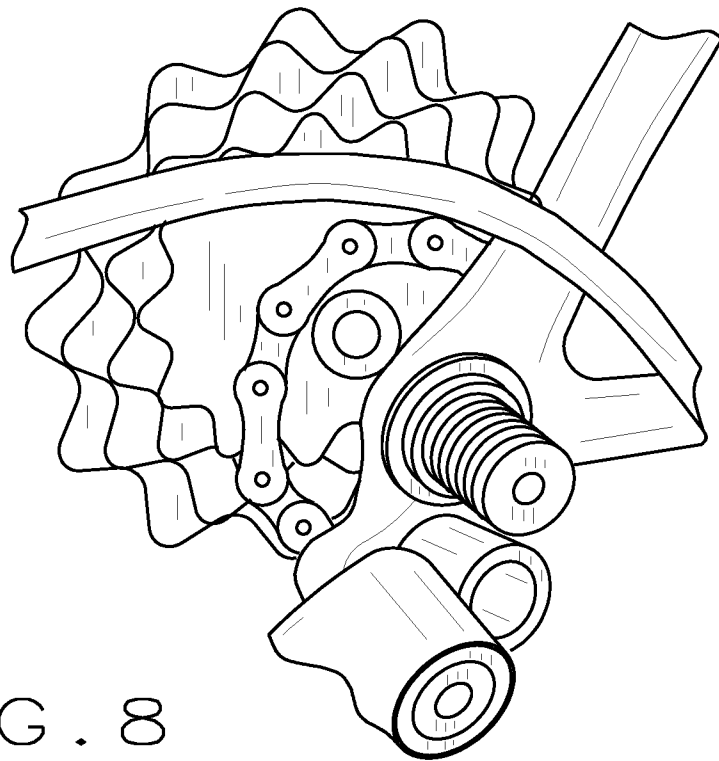


FIG. 8

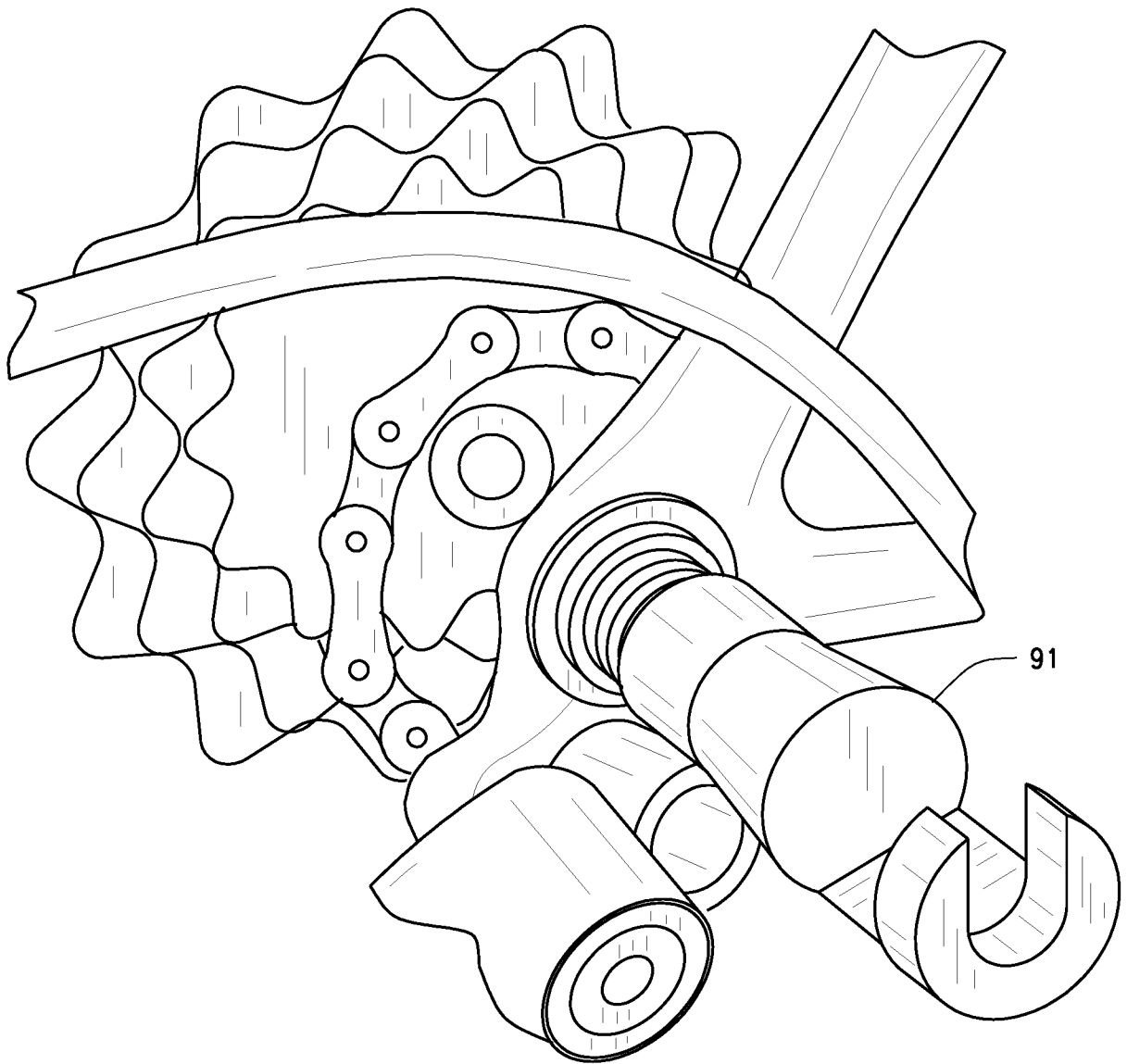


FIG. 9

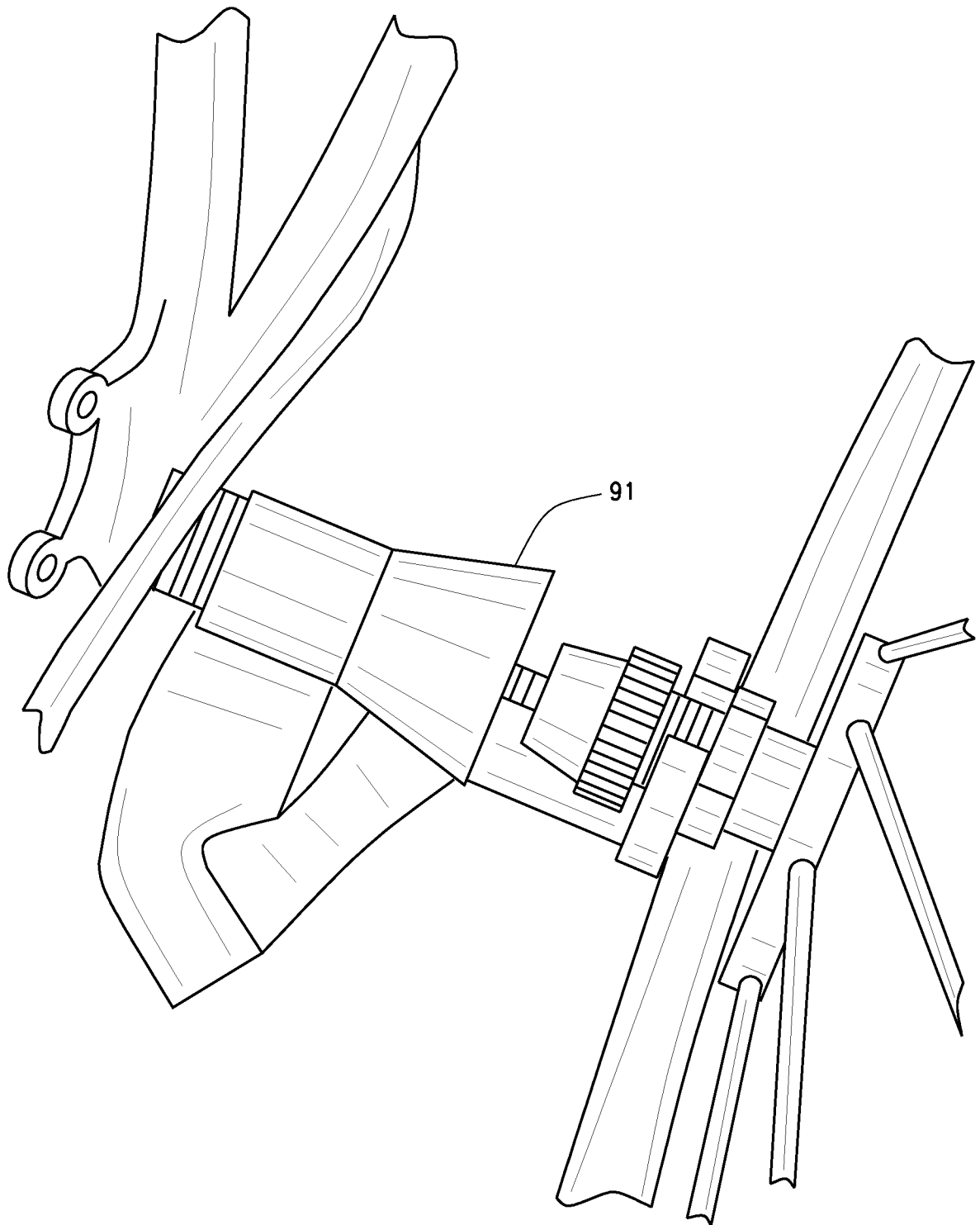


FIG. 10

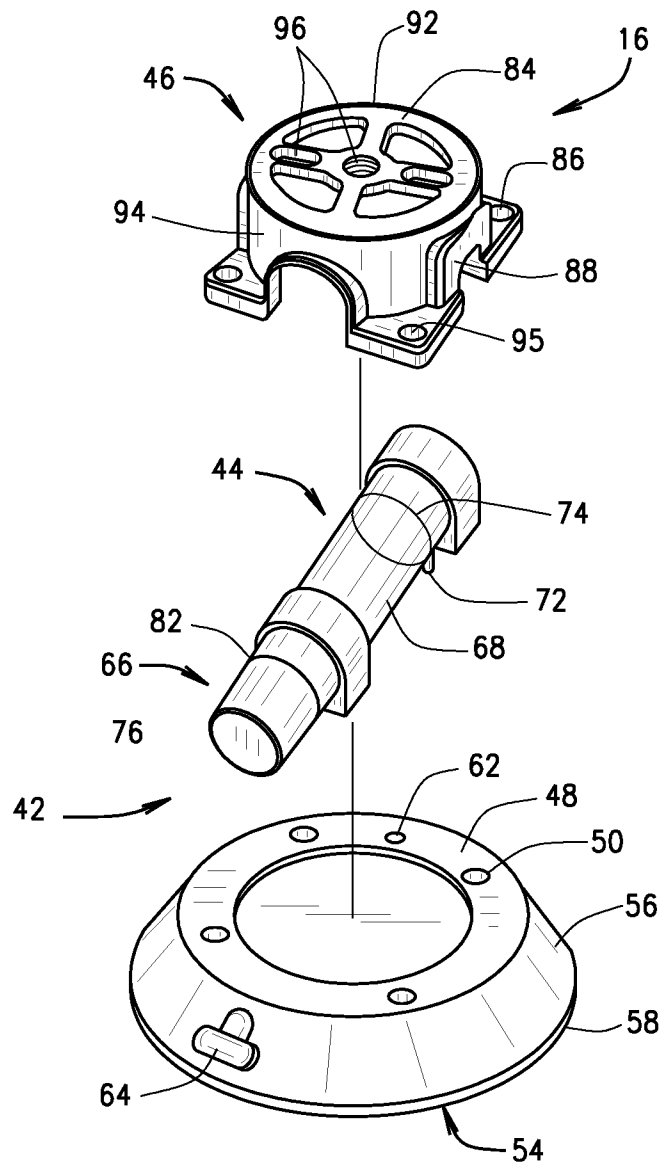


FIG. 11

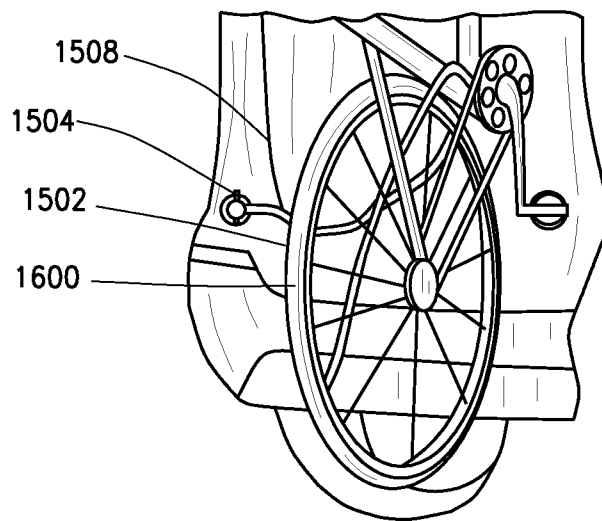


FIG. 12

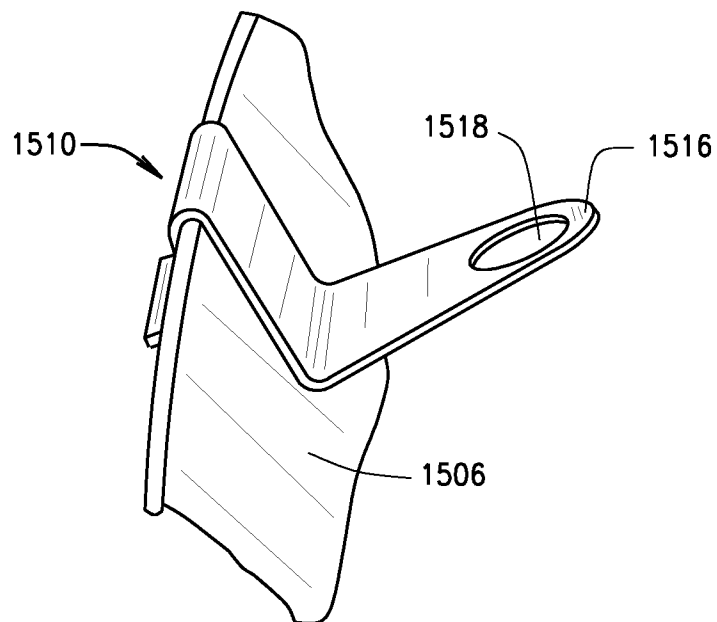


FIG. 13

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 16/51975

A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - B60R 9/00, 9/08, 9/10, 11/00, F16B 47/00, F16M 13/02 (2016.01) CPC - B60R 9/00, 9/08, 9/10, 11/00, 2011/0056, F16B 47/00, F16M 13/02, 13/022 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC (8): B60R 9/00 (2016.01); CPC: B60R 9/00 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched IPC (8): A47F 7/00, B42D 15/00, B60P 3/00, B60P 3/06, B60P 3/10, B60R 9/00, B60R 9/02, B60R 9/04 (2016.01); CPC: A47F 7/00, A01K 97/00, A01K 97/06, A01K 97/08, A01K 97/10, B42D 15/00, B60P 3/00, B60P 3/06, B60P3/10 (keyword limited; terms below) Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) PatBase; Google Patents; Google Web; Search Terms Used: vehicle vehicles car cars convertible convertibles truck trucks automobile automobiles van vans bus buses boat boats hold# frame# secure# receptacle# structure# support# rack# carry# bar# load# clamp# article articles bike bikes bicycle bicycles ski skis snowboard snowboards surfboard		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2014/0076949 A1 (Casagrande) 20 March 2014 (20.03.2014), entire document, especially Fig. 1, Fig. 2, Fig. 3; para [0047], para [0051], para [0053], para [0054], para [0055], para [0057], para [0059].	1
X	US 2012/0168481 A1 (Casagrande) 05 July 2012 (05.07.2012), entire document.	1
A	US 2013/0299667 A1 (Casagrande) 14 November 2013 (14.11.2013), entire document.	1
A	'PUSHYS REVIEW: Sea Sucker Talon Bike Rack'. Pushys Online. 12 March 2014 (12.03.2014) [online], [retrieved on 16/12/2016]. Retrieved from the internet: <URL: https://www.youtube.com/watch?v=VYiqI4ECaJl >. Entire document.	1
A	US 6,705,822 B2 (Oldak) 16 March 2004 (16.03.2004), entire document.	1
A	US 2010/0264285 A1 (Buelna) 21 October 2010 (21.10.2010), entire document.	1
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/>		
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Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300		Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774