(12) UK Patent Application (19) GB (11) 2502188 (13) A

(43) Date of A Publication 20.11.2013

(21) Application No: 1305339.2

(22) Date of Filing: 22.03.2013

(30) Priority Data:
(31) 61620324 (32) 04.04.2012 (33) US

(51) INT CL:
B62D 53/08 (2006.01)

(56) Documents Cited:
GB 1386084 A
GB 0418400 A
US 5860668 A
US 4088339 A
US 20110057416 A1

(58) Field of Search:
INT CL B62D
Other: Online: WPI, EPODOC

(71) Applicant(s):
Daimler AG
(Incorporated in the Federal Republic of Germany)
Mercedesstrasse 137, D-70327 Stuttgart, Germany

(72) Inventor(s):
Justin Yee
Robert Lawson
Barny Outen

(74) Agent and/or Address for Service:
Hofstetter Schurack & Partner
Balanstr 57, D-81541 München, Germany

(54) Title of the Invention: **Vehicle fifth wheel support structure**
Abstract Title: **A fifth wheel support structure for a vehicle**

(57) A fifth wheel support structure 1 for a vehicle, comprises a frame 2 and a support for a fifth wheel, the frame 2 comprising a pair of left and right side beams 20 and a cross member structure 22 with a first frame cross member 30 and a second frame cross member 32, the first frame cross member 30 extending from a forward end portion of a first one of the side beams 20 to a rear end portion of the second side beam 20, and the second frame cross member 32 extending from a forward end portion of the second side member 20 to a rear end portion of the first side member 20. The support structure 1 comprises spring engaging members 36 coupled to the distal end portions of the cross members 30, 32.

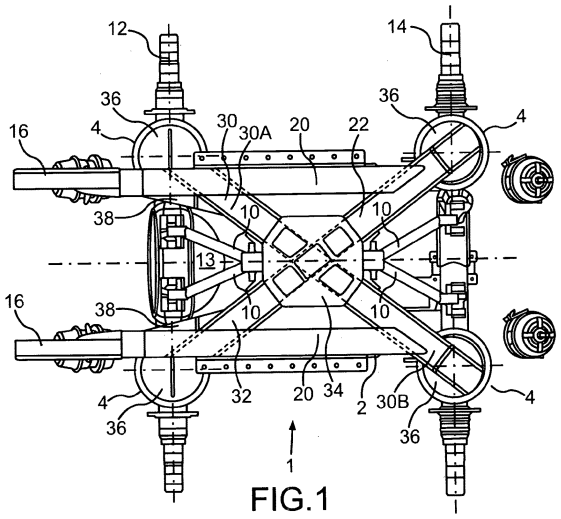

FIG.1

GB 2502188 A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 2007.

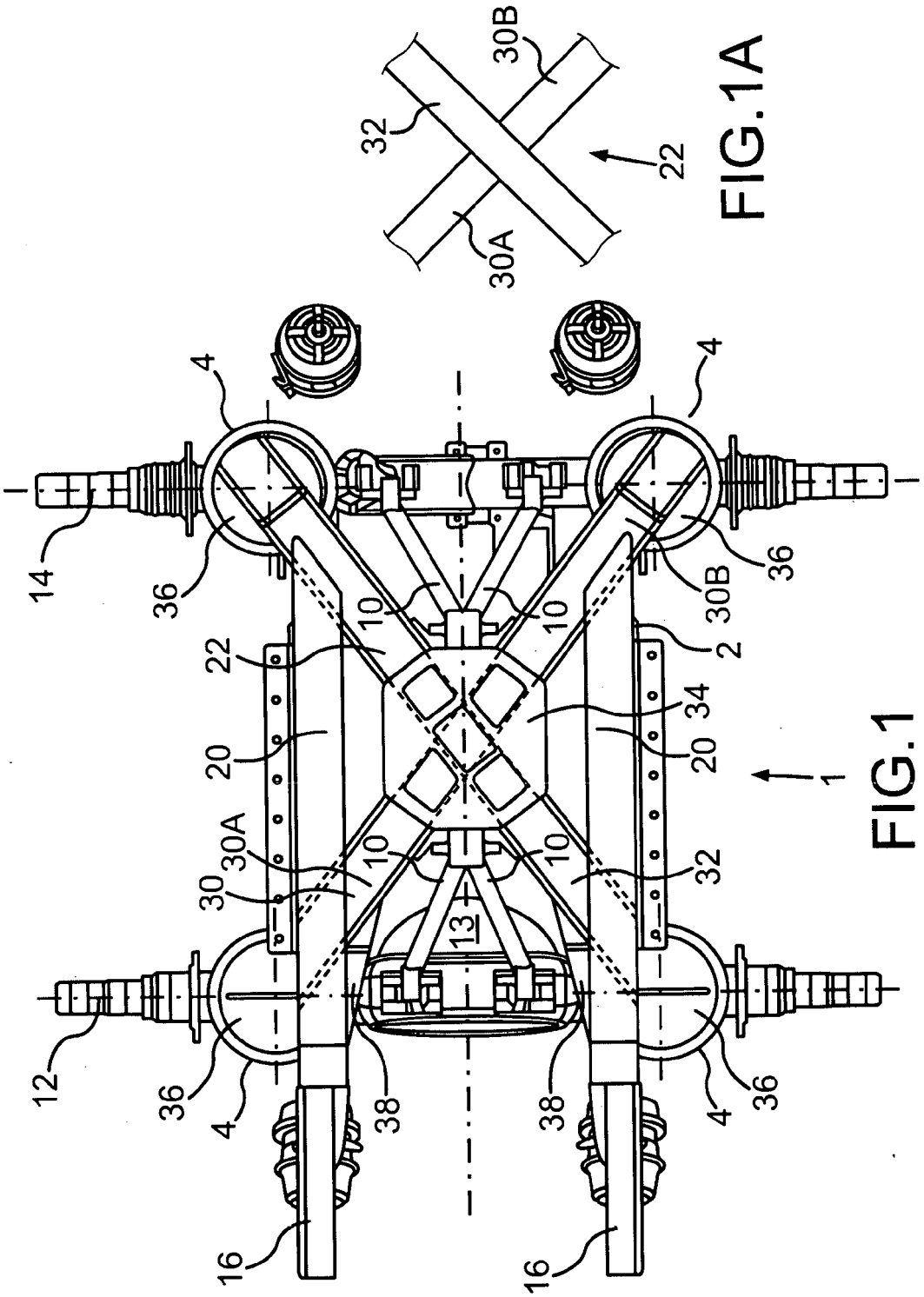

FIG.1A

FIG.1

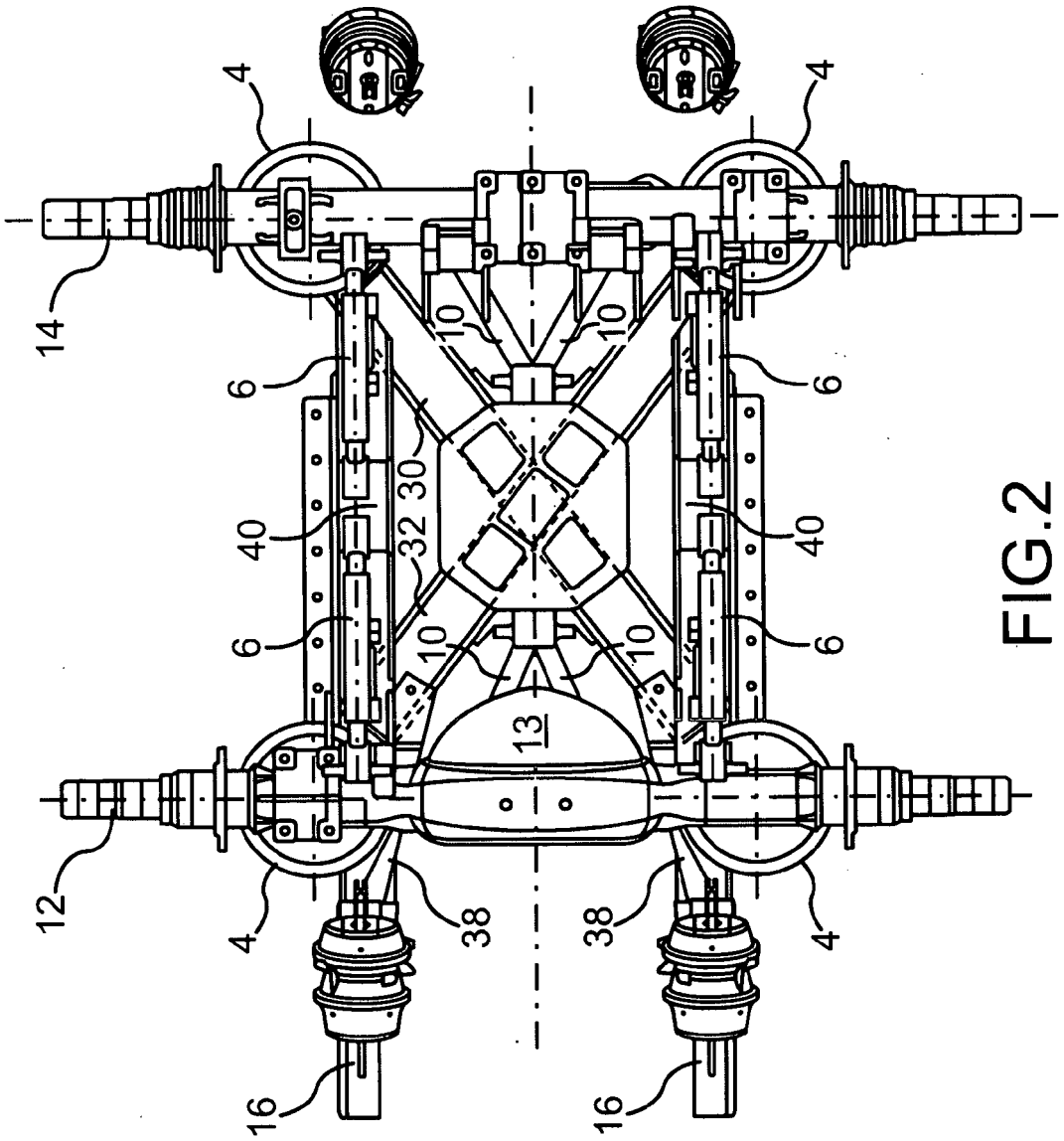

FIG.2

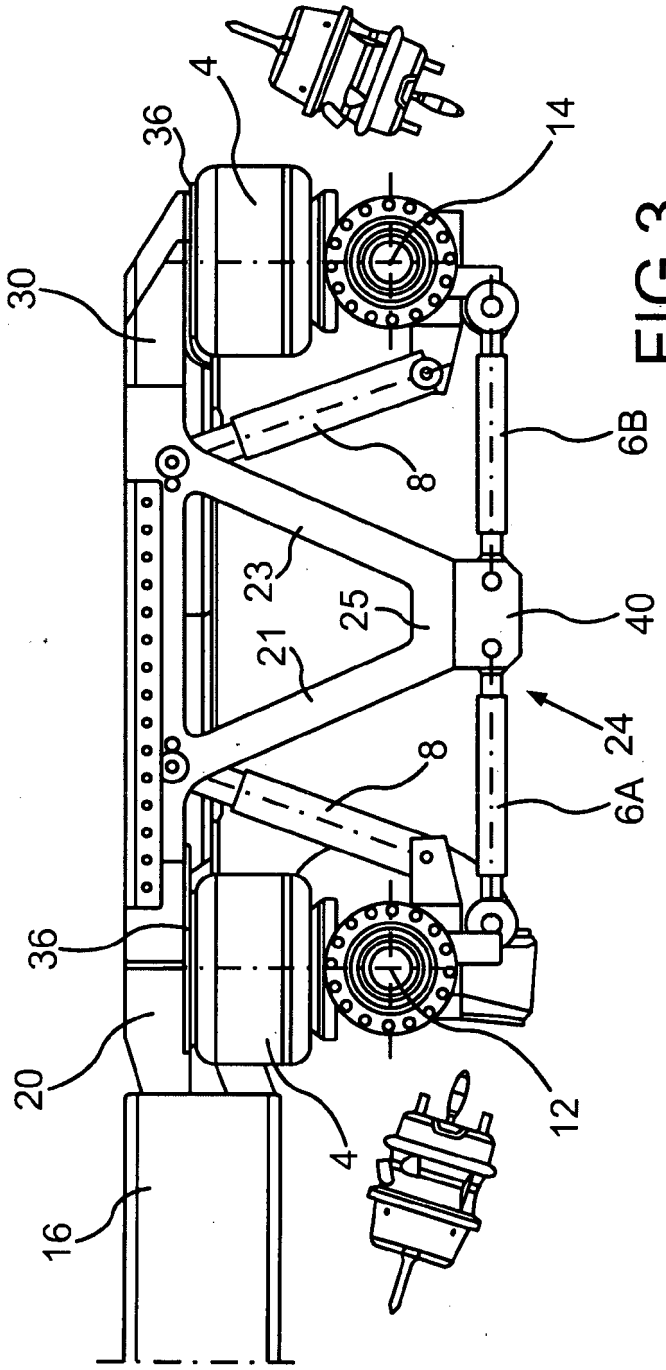

FIG.3

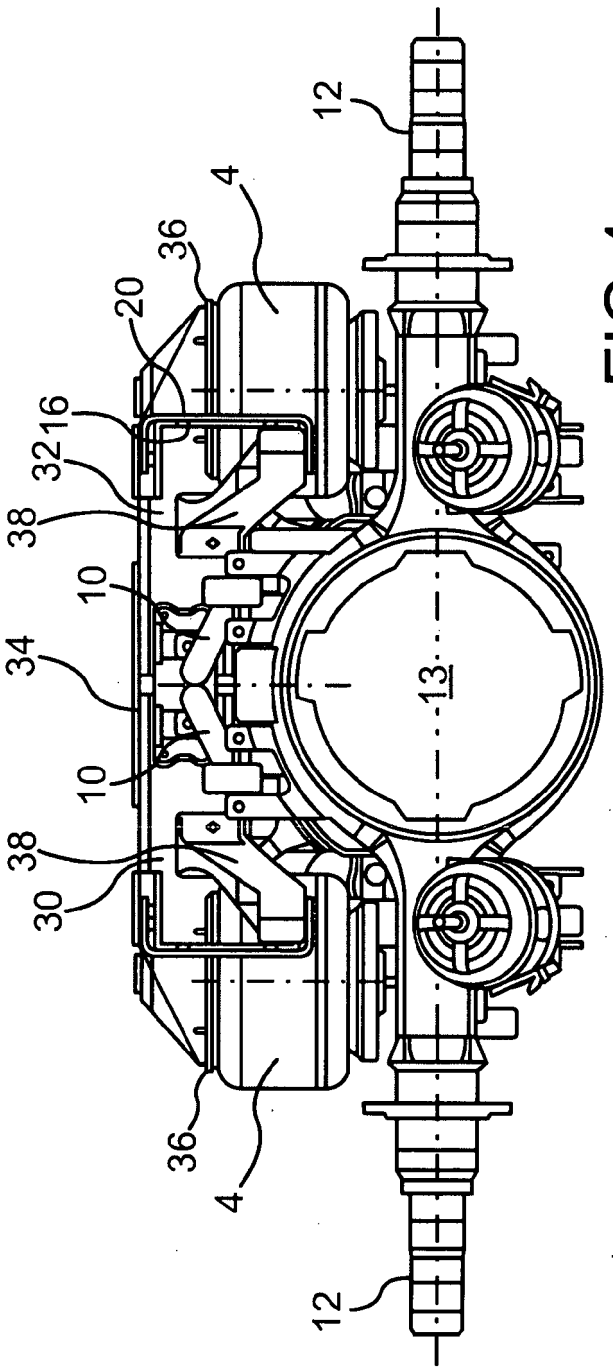

FIG.4

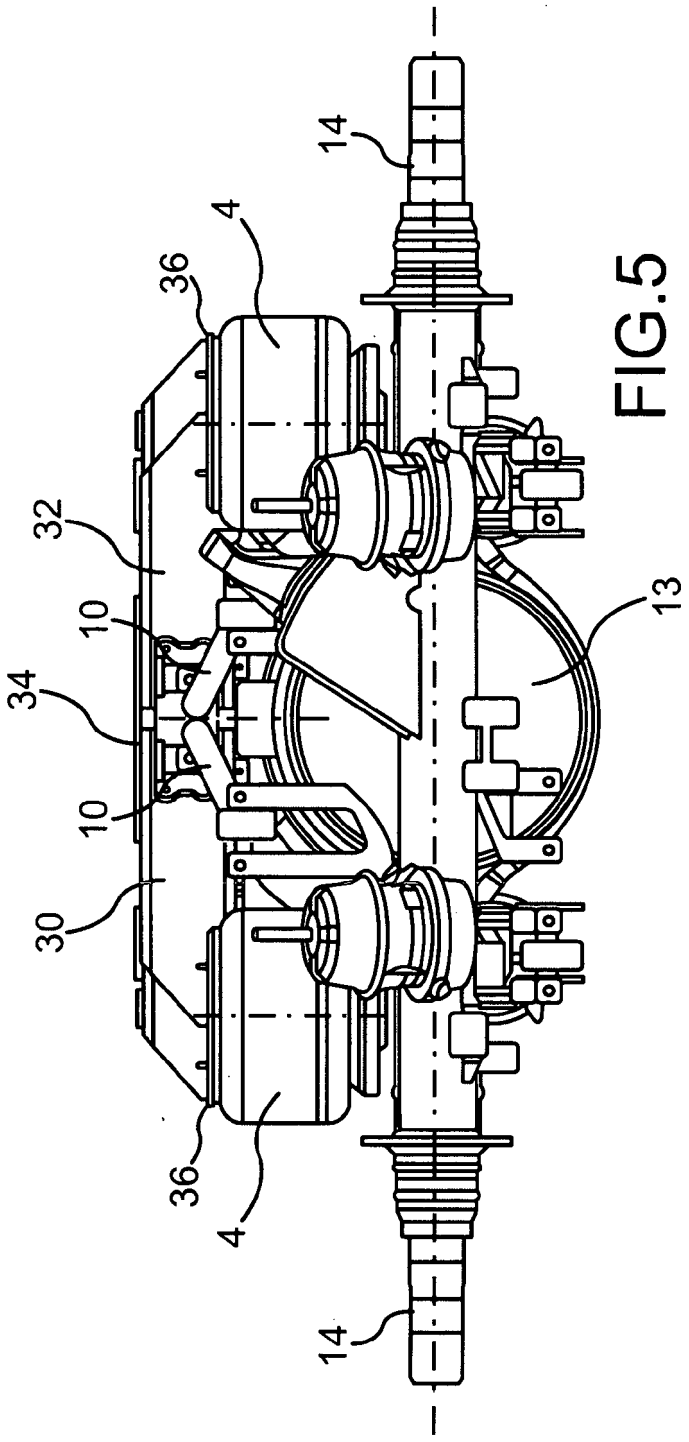

FIG.5

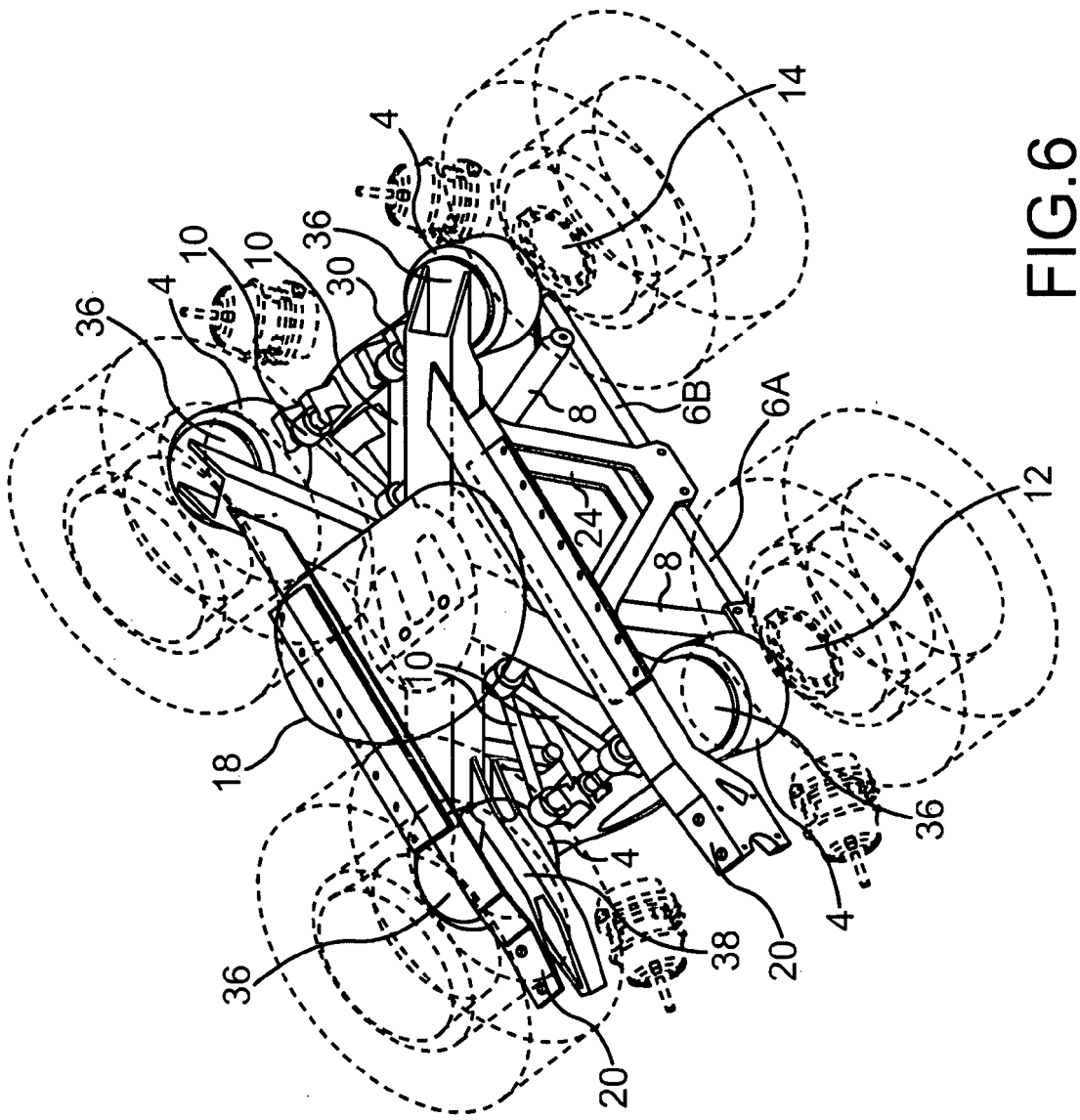

FIG.6

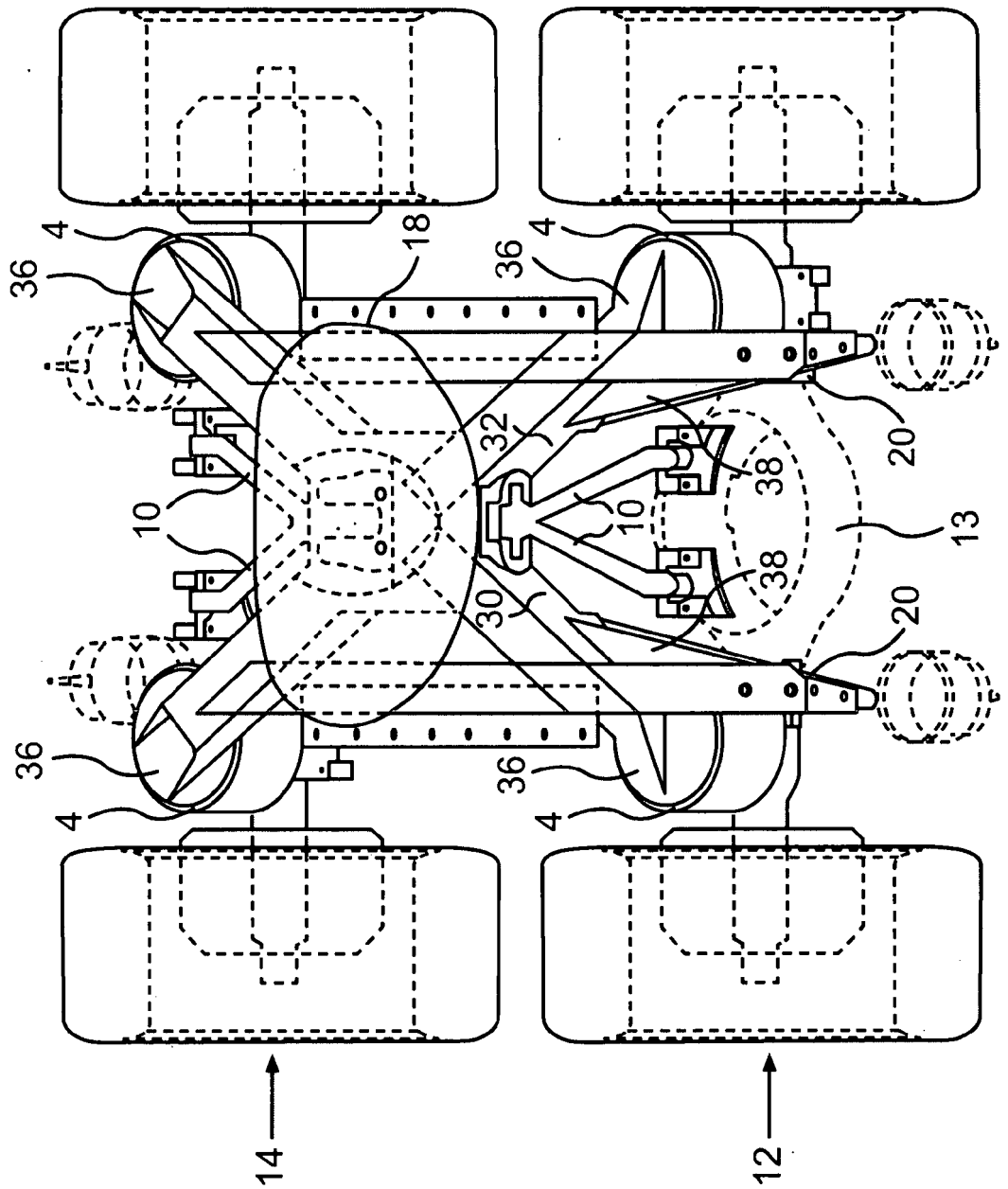

FIG.7

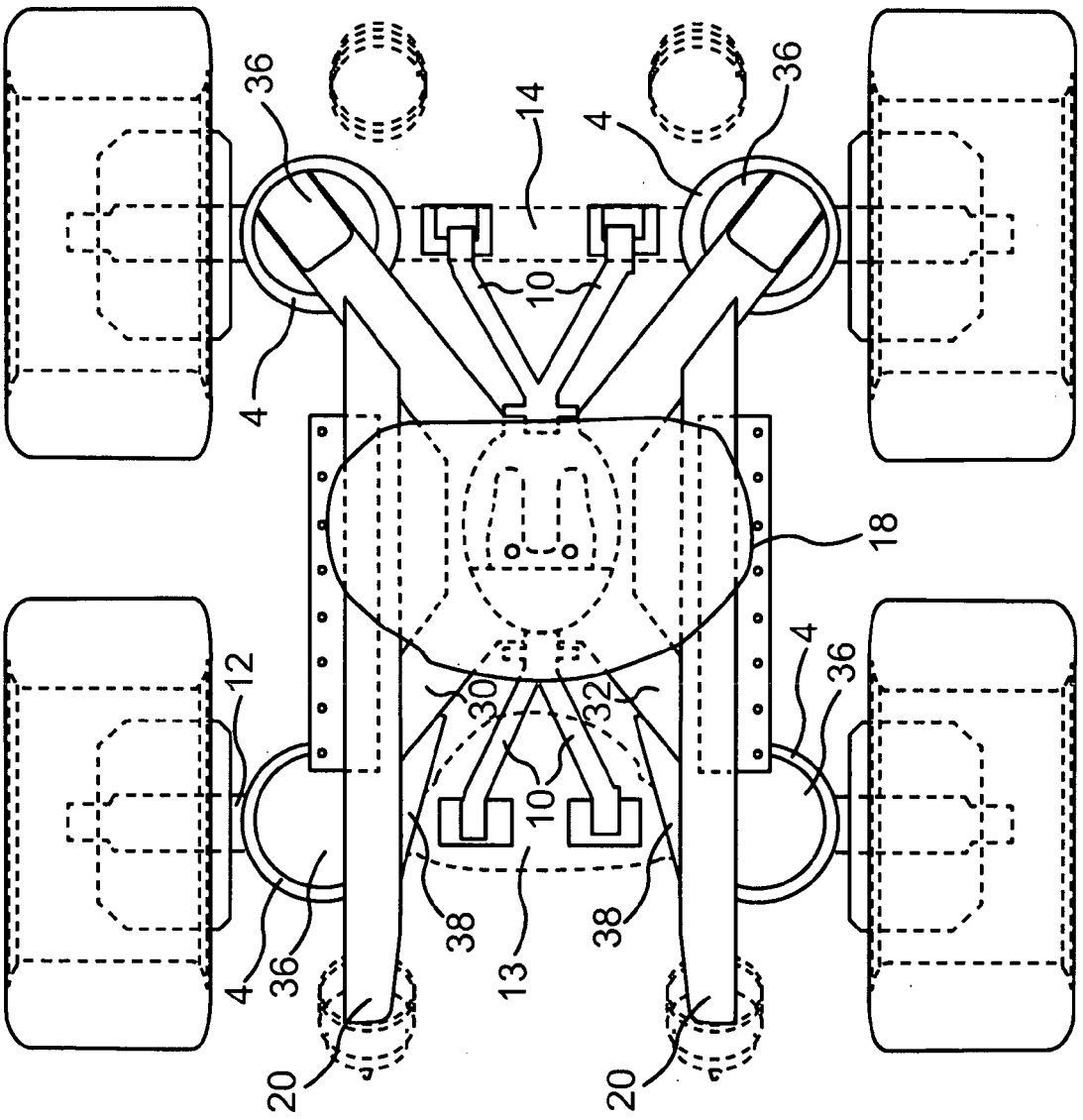

FIG.8

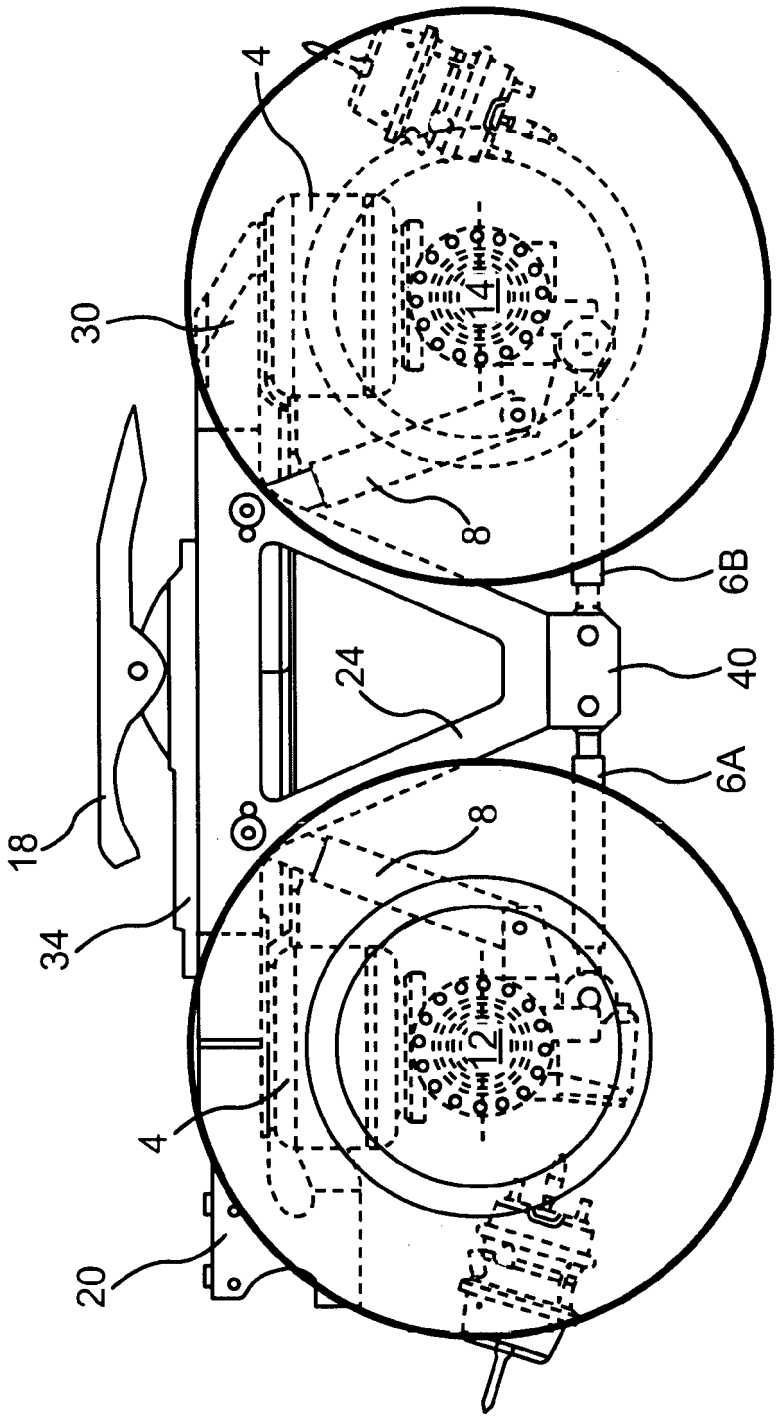

FIG.9

VEHICLE FIFTH WHEEL SUPPORT STRUCTURE

Described herein are embodiments of a fifth wheel support structure for a vehicle. The following description is exemplary in nature and is not intended to limit the scope, applicability, or configuration of the invention in any way. Various changes to the described embodiments may be made in the function and arrangement of the elements described herein without departing from the scope of the invention.

The attached FIGS. 1-9 show several views of an exemplary fifth wheel support structure 1 that can be included in a vehicle, such as a truck. The support structure 1 can include a frame 2 (such as shown in salmon color in FIGS. 6-9), air springs 4 (such as shown in blue in FIGS. 6-9), control rods 6 (such as shown in light green in FIGS. 6-9), shock absorbers 8 (such as shown in dark green in FIGS. 6-9), and track rods 10 (such as shown in hot pink in FIGS. 6-9). The structure 1 can be coupled to a front axle 12 and a rear axle 14 of the vehicle (both the front and rear axles 12, 14 are typically positioned near the rear of the vehicle and are both rearward of frontmost vehicle axle), and coupled to left and right frame rails 16, 16A of the vehicle. In some embodiments, the front axle 12 can be a drive axle while the rear axle 14 is not. The support structure 1 can comprise a support for a fifth wheel 18, such as shown in FIG. 6, coupled to the frame 2 for attaching a trailer to the vehicle. The support structure 1 can comprise a modular unit that can be manufactured and/or assembled independently from the rest of the vehicle frame, and then later bolted or otherwise coupled to the frame rails 16 and to the axles 12, 14.

The frame 2 can comprise a pair of left and right side beams, or stub beams, 20 that extend longitudinally in a front-to-rear direction and that can be coupled to rear end portions of the frame rails 16 of the vehicle. The frame 2 can further comprise a cross-member structure 22, such as comprising first and second intersecting beam or cross-member portions that can have an "X-frame" configuration. The cross-members of structures 22 interconnect the left and right beams 20. That is, a first frame cross member

can extend from a forward end portion of a first one of the stub beams 20 to an aft or rear end portion of the second stub beam, and a second frame cross member can extend from a forward end portion of the second stub member to a rear end portion of the first stub beam.

The frame can further comprise left and right truss portions 24 that extend downwardly from the respective stub beams 20. The truss portions can be integral portions of the stub beams 20 or separate components coupled to the stub beams. In one embodiment, as shown in FIG. 3, the truss portions comprise reinforcing members 21, 23 that converge moving downwardly from the stub beams and are joined together at their lower distal ends by a connecting portion 25. The illustrated truss structure 24 in one form comprises a V-shaped reinforcing truss structure. One such V-shaped structure can extend downwardly from each of the left and right side beams 20, respectively.

The X-frame 22 can comprise a first cross rail 30 (FIG. 1) extending diagonally from above the right side of the rear axle 14 to above the left side of the front axle 12 and a second cross rail 32 extending diagonally from above the left side of the rear axle to above the right side of the front axle. The cross rails 30, 32 can comprise box beams with a generally rectangular cross-section. In some embodiments, one of the cross rails can comprise two segments that are welded, bolted, or otherwise rigidly coupled, to an intermediate portion of the other cross rail, such that the two cross form a rigid intersection. For example, as shown in FIG. 1A, the cross rail 30 can comprise a front section 30A and a rear section 30B that have respective inward ends that are welded or otherwise secured to an intermediate portion of the other cross rail 32 to form an intersection of the cross rails. In other embodiments, the cross rail 32 can comprise two segments and can be coupled to a one-piece cross rail 30, or both cross rails can comprise plural segments that are all coupled together at inward end portions to form a rigid intersection.

A fifth wheel support, such as a plate 34, can be positioned above the intersection of cross rails 30, 32 to support a fifth wheel 18, as shown in FIGS. 6-9. The term "fifth wheel" means any apparatus configured to couple a trailer to the towing vehicle. The plate 34 can comprise fifth wheel coupling components that facilitate the adjustability of the fifth wheel 18 in a front-to-rear direction relative to the frame 2. Fore-to-aft, and vice versa, adjustable fifth wheels are known.

Air spring engaging members, such as plates 36 in FIG. 6, can be mounted or otherwise coupled to the distal end portions of the cross rails 30, 32, with each plate or support desirably being positioned below the end of an associated cross rail and above a respective associated air spring 4. The plates 36 can be similar in shape to the top surface of the air springs 4 and can engage the upper ends of the air springs 4. For example, as illustrated in FIG. 8, the air springs 4 have a cylindrical shape and the lower plates 36 have a circular shape and can be slightly smaller in diameter than the diameter of the air springs 4. The lower surfaces of the air springs 4 can, for example, be coupled to the axles 12, 14 via an air spring bracket.

As shown in FIG. 1, each of the side beams or frame rail sections 20 can terminate at a rear end that is coupled to a rear end portion of one of the cross rails 30, 32 and that is adjacent or proximate, and desirably just forward of the lower plates 36 and rear air springs 4. The side beams 20 can also be coupled to the cross rails 30, 32 at a second location adjacent to the front air springs 4 above the front axle 12. The side beams 20 can extend forwardly to a location forward of the front axle 12 and can comprise front end portions that are configured to be coupled to rear end portions of the frame rails 16 of the vehicle. As shown in FIG. 6, additional reinforcing members 38 can be provided, such as one elongated reinforcement positioned at each side of the frame 2. Each reinforcement member 38 can have a rear end coupled to a respective one of the cross rails 30, 32 and a front end coupled to a respective front end portion of an associated side beam 20.

In the illustrated example shown in FIGS. 3, 6 and 9, the illustrated V-shaped truss portions 24 of the frame 2 extend downwardly from an intermediate portion of each side beam 20 between the front axle 12 and the rear axle 14. The lower apex 40 of the V-shaped portions can extend below the elevation of the axles when the axles are in a horizontal plane.

The frame 2 can be comprised of one or more rigid materials, such as steel, and can be a static structure (such as shown in salmon in FIGS. 6-9) wherein each of its components are fixed together in a generally permanent manner, such as by one or more of welding, riveting or bolting. If the frame components are of composite materials, adhesive securing or bonding methods can be used.

At the respective sides of the frame 2, a first control rod 6A can extend from the lower apex 40 of the structure 24 to the front axle 12 and a second control rod 6B can extend from the lower apex 40 to the rear axle 14. These control rods can extend horizontally when the vehicle axles are at its design load on level ground. The control rods 6 are desirably each pivotally coupled at one end to structure 14 and at the opposite end to their associated axle. The control rods provide for torsional stability to the overall structure 1. The shocks absorbers 8 can be coupled at a lower end to the axles adjacent to the wheels and coupled at a top end to the side rails 20 adjacent to the top ends of the V-shaped portions 24. The shock absorbers 8 are pivotally coupled at their ends to connecting structures or brackets and are resiliently compressible to absorb shock from the axles.

Track rods 10 (FIG. 1) can be coupled at an upper end to the X-frame 22 near the intersection of the cross rails 30, 32 and can be coupled at a lower end to an intermediate portion of the axles 12, 14. In the illustrated example, a front pair of track rods 10 are coupled to a common bracket adjacent to and forwardly of the intersection of the cross rails 30, 32 and are coupled at lower ends to respective spaced apart brackets on top of a transfer case 13 of the front axle 12. Similarly, a rear pair of track rods 10 in the illustrated example are coupled to a common bracket adjacent to and rearwardly of the intersection of the cross rails 30, 32 and are also coupled at lower ends to respective spaced apart brackets mounted on top of the rear axle 14. Each of the track rods 10 is desirably pivotally coupled at both ends to provide flexibility as the axles move relative to the frame while providing enhanced front-rear and side-to-side stability to the frame 2.

The air springs 4 can be resiliently compressible and can absorb shock and vibrations from the axles 12, 14 to reduce the impact of the vibrations on the frame 2. The lower surfaces of the air springs 4 can be coupled to the axles, such as by brackets, and upper surfaces of the air springs 4 can be coupled to the lower plates 36 of the frame 2. The air springs 4 can be generally cylindrical and have an upwardly extending centerline. In some embodiments, at least a portion of each air spring is positioned above the respective axle and of the axle to which it is coupled. In some embodiments, the centerline of each air spring intersects the respective axle. In a particular embodiment, the centerline of each air spring is aligned with the longitudinal centerline of the respective axle. By positioning the air springs at least partially over the axles, rather than

rearward or forward of the axles, loads from the frame 2 are transferred more directly to the axles.

In use, a trailer can be hitched to the vehicle using the fifth wheel 18, thereby imparting substantial loads on the vehicle. The described support structure 1 can advantageously distribute forces from the trailer (e.g., gravitational and torsional forces such as when the trailer is cornering) more directly to the axles 12, 14. A primary component of the trailer load is distributed from the fifth wheel 18, through the plate 34, in four directions along the cross rails 30, 32 of the X-frame to the corners of the X-frame. Those loads are transferred from the four ends of the cross rails, through the lower plates 36, to the air springs 4. The air springs 4 transfer the loads downwardly to the axles below. In addition, portions of the load from the trailer are transferred directly from the cross rails 30, 32 to the axles via the track rods 10. Consequently, most of the trailer load is transferred to the axles without passing through the side beams 20. That is, in this desirable embodiment only, a minor portion of the load will be transferred from the cross-rails 30, 32 to the side beams 20 and then distributed through the shocks 8 or the truss portions 24 and the control rods 6 to the axles 12, 14. The reduced load on the side beams 20 allows for the side beams to be smaller and/or lighter in weight and can eliminate the need for the more robust and heavier frame rails 16 to be elongated all the way back to the rear axle 14 in order to support the trailer loads. Also, the fifth wheel support structure 1 can be assembled with the axles as a separate module with the assembled module being thereafter coupled to the frame rail ends. This provides manufacturing efficiencies. The modular component can be bolted onto and/or removed from the rear of the frame rails.

As used in this application, the singular forms "a," "an," and "the" include the plural forms unless the context clearly dictates otherwise. The phrase "and/or" means "and", "or" and both "and" and "or". The term "includes" means "comprises." Further, the term "coupled" generally means mechanically, electrically, magnetically and/or chemically coupled or linked and does not exclude the presence of intermediate elements between the coupled or associated items absent specific contrary language.

In view of the many possible embodiments to which the principles of the disclosed invention may be applied, it should be recognized that the illustrated embodiments are only preferred examples of the invention and should not be taken as

limiting the scope of the invention. Rather, the scope of the invention is defined by the following claims. We therefore claim as our invention all that comes within the scope of these claims.

Claims

1. A fifth wheel support structure (1) for a vehicle, the fifth wheel support structure (1) comprising a frame (2) and a support for a fifth wheel (18), the frame (2) comprising:

   - a pair of left and right side beams (20) and
   - a cross member structure (22) with a first frame cross member (30) and a second frame cross member (32),

   the first frame cross member (30) extending from a forward end portion of a first one of the side beams (20) to a rear end portion of the second side beam (20), and the second frame cross member (32) extending from a forward end portion of the second side member (20) to a rear end portion of the first side member (20).

2. The fifth wheel support structure (1) according to claim 1, characterized in that, the fifth wheel support structure (1) comprises spring engaging members (36) coupled to the distal end portions of the frame cross members (30, 32).

3. The fifth wheel support structure (1) according to any one of claims 1 or 2, characterized in that, the fifth wheel support structure (1) is being capable of being assembled with axles (12, 14) of the vehicle as a separate module, the assembled module being thereafter capable of being coupled to rear end portions of frame rails (16) of the vehicle.

INTELLECTUAL PROPERTY OFFICE

Application No: GB1305339.2 **Examiner:** Mr Colin Thompson

Claims searched: 1-3 **Date of search:** 12 September 2013

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1,2	GB 418400 A (Lagache et Glaszmann) See Fig 1
X	1	GB 1386084 A (Poole) See Fig 5
X	1	US 5860668 A (Hull) See Fig 3
X	1	US 4088339 A (Sagebiel) See Fig 1
X	1	US 2011/0057416 A1 (Mann) See Fig 7

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

B62D

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC

International Classification:

Subclass	Subgroup	Valid From
B62D	0053/08	01/01/2006