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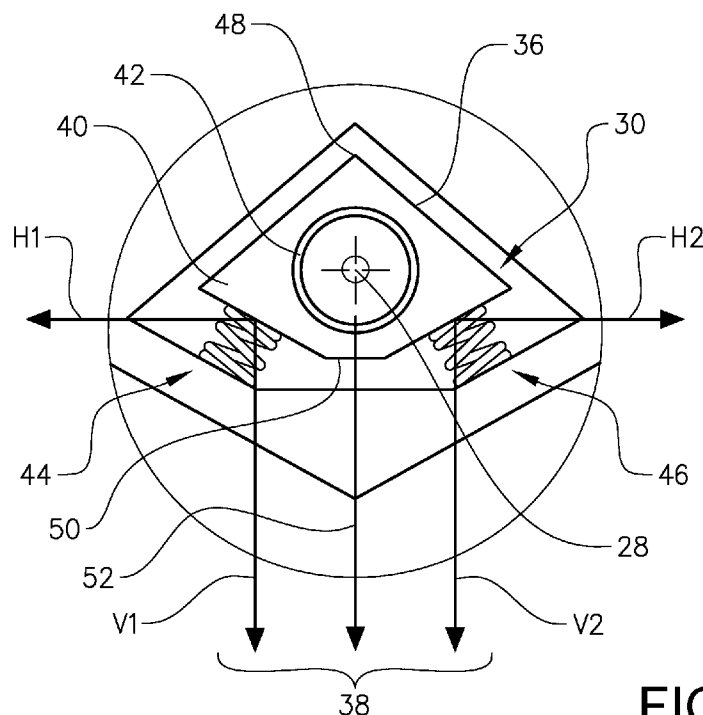


FIG. 2

(57) Abstract: The present disclosure relates to a suspension arrangement (30) for a bogie beam (26) for a vehicle (10). The suspension arrangement (30) comprises a connector (36) having a means for pivotally connecting the connector (36) to a vehicle main body (12) for pivoting around a substantially horizontal bogie pivot axis (28). The suspension arrangement (30) further comprises a resilient means (38) for connecting the connector (36) and the bogie beam (26) to each other.

SUSPENSION ARRANGEMENT

TECHNICAL FIELD

The present disclosure relates to a suspension arrangement according to the preamble of claim 1. Moreover, the present disclosure relates to a bogie beam assembly and/or a
5 vehicle.

The present disclosure can be applied in heavy-duty vehicles, such as trucks, buses and construction equipment. Although the invention will be described with respect to an articulated hauler, the invention is not restricted to this particular vehicle, but may also be
10 used in other vehicles, for instance other types of work machines such as a wheel loader, a dumper truck, or any other type of construction equipment.

BACKGROUND

A vehicle, for instance a work machine, may comprise a bogie beam from which two or
15 more wheels are suspended. Generally, such a bogie beam is pivotally connected to a vehicle portion, such as a vehicle frame.

US 4,324,417 discloses a bogie beam system that comprises a variable spring means connecting a portion of the bogie beam to a vehicle frame in order to mitigate the pivot
20 motion of the bogie beam relative to the vehicle frame.

Although the US 4,324,417 system may be appropriate for many applications, there is still a need for improving bogie beam systems.

25 SUMMARY

An object of the present disclosure is to provide a reliable suspension arrangement for a bogie beam for a vehicle. The above object is achieved by the suspension arrangement according to claim 1.

30 As such, the present disclosure relates to a suspension arrangement for a bogie beam for a vehicle. The suspension arrangement comprises a connector having a means for pivotally connecting the connector to a vehicle main body for pivoting around a substantially horizontal bogie pivot axis.

According to the present disclosure, the suspension arrangement further comprises a resilient means for connecting the connector and the bogie beam to each other.

By virtue of the fact that the resilient means is adapted to connect the connector to the bogie beam, the magnitude of displacements of the bogie beam relative to the vehicle main body, such as a vehicle frame of the vehicle main body, may be reduced in a straightforward manner.

This in turn implies that the vehicle hosting the suspension arrangement may be driven at a higher speed on an uneven ground, as compared to a vehicle not equipped with the suspension arrangement, even when the vehicle is driven in an unloaded condition (or a condition with low load) in which the suspension from the wheels connected to the bogie beam may be low.

For instance, the intended position of the resilient means, viz between the connector and the bogie beam, implies a space efficient suspension of the bogie beam.

Further, by virtue of the fact that the connector has a means for pivotally connecting the connector to a vehicle main body, the resilient means may be designed with a focus on providing an appropriate suspension in at least the vertical direction. This in turn implies an appropriate versatility in the design of the resilient means.

As a non-limiting example, the pivotally connecting means may be such that the connector can pivot within at least a predetermined pivot range around the substantially horizontal bogie pivot axis. Purely by way of example, the size of the predetermined pivot range may be at least 10°. For instance, the predetermined pivot range may be a deviation of at least $\pm 5^\circ$ from an initial angular position of the connector.

Moreover, and again as a non-limiting example, the resilient means may be such that a relative motion of at least 10 millimeters, alternatively at least 30 millimeters, optionally more than 40 millimeters, between the connector and the bogie beam can be obtained. For instance, the relative motion may be a substantially vertical relative motion.

Optionally, the suspension arrangement comprises a bearing, such as a slide bearing or a roller bearing, at least a portion of which forming part of the means for pivotally connecting

the connector to the vehicle main body. The bearing implies a cost efficient way of pivotally connecting the connector to the vehicle main body.

Optionally, the resilient means comprises a first resilient member. Optionally, the first
5 resilient member comprises a rubber spring, preferably a rubber shear spring. By virtue of a rubber spring, a reliable and durable resilient means may be obtained.

Optionally, the resilient means comprises a second resilient member. Optionally, the second resilient member comprises a rubber spring, preferably a rubber shear spring.

10

Optionally, the connector has a connector extension in a connector direction. The connector direction extends from a connector top portion to a connector bottom portion.

Optionally, the vehicle extends in a vertical direction that is positive in a direction from the
15 ground up towards the vehicle and the connector direction substantially extends in a negative vertical direction when the connector is connected to the vehicle main body.

Optionally, the first resilient member is adapted to extend from the connector to the bogie beam in a direction having a component extending in the connector direction.

20

Optionally, the second resilient member is adapted to extend from the connector to the bogie beam in a direction having a component extending in the connector direction.

An extension in the connector direction for the first and/or the second resilient member
25 implies that the suspension by the resilient member may be achieved at least partially by a compression of the resilient member. Many types of resilient members, such as e.g. rubber elements, generally have better suspension characteristics when operating in a compressed state than when operating under tensile strain.

30 Optionally, the first resilient member is adapted to extend from the connector to the bogie beam in a first direction having a component extending in a first horizontal direction, perpendicular to the connector direction, and the second resilient member extends from the connector to the bogie beam in a second direction having a component extending in a second horizontal direction. The second horizontal direction is substantially opposite to
35 the first horizontal direction.

The above horizontal directions imply that the first and second resilient members substantially keep the horizontal position of the connector in relation to the bogie beam.

- 5 A second aspect of the present disclosure relates to a bogie beam assembly comprising a bogie beam and a suspension arrangement according to the first aspect of the present disclosure. The resilient means connects the connector to the bogie beam.

- Optionally, the bogie beam comprises a bogie beam abutment portion. The connector has
10 a connector abutment portion which is adapted to abut a portion of the bogie beam abutment portion when the resilient means has been deformed to a predetermined extent.

- By virtue of the fact that a connector abutment portion is adapted to abut the bogie beam abutment portion, the bogie beam may be pivoted relative to a portion of a vehicle, such
15 as a vehicle frame, even if the resilient means has been deformed to a large extent and/or even if the resilient means has ceased to function properly, e.g. due to a resilient means failure. This in turn implies that the basic functionality of the bogie beam, viz the ability to pivot relative to a vehicle portion, may not be dependent on the function of the resilient means.

- 20 Optionally, the bogie beam assembly comprises an initial gap between the connector abutment portion and the bogie beam abutment portion. Preferably, the initial gap may be at least 10 millimetres, more preferred at least 30 millimetres, alternatively at least 40 millimetres. The initial gap may be obtained when the vehicle is in an unloaded condition.
25 Moreover, the bogie beam assembly may be such that the connector abutment portion abuts the portion of the bogie beam recess wall when the vehicle is in a loaded condition. In a loaded condition, sufficient suspension may be obtained from the wheels connected to the bogie beam assembly.

- 30 Optionally, the connector abutment portion and the portion of the bogie beam recess wall are such that when the connector abutment portion abuts the portion of the bogie beam recess wall, the bogie beam may be pivoted relative to a portion of a vehicle in both a positive and a negative direction.

As a non-limiting example, the connector abutment portion and the portion of the bogie beam recess wall may be such that when the connector abutment portion abuts the portion of the bogie beam recess wall, at least two abutment points are obtained which are located at a distance from one another. Purely by way of example, the connector
5 abutment portion and the portion of the bogie beam recess wall may have corresponding shapes.

Optionally, the bogie beam comprises a bogie beam cavity delimited by a bogie beam cavity wall, preferably said bogie beam cavity wall comprising the bogie beam abutment
10 portion.

A third aspect of the present disclosure relates to a vehicle, preferably an articulated hauler, comprising a suspension arrangement according to the first aspect of the present disclosure and/or a bogie beam assembly according to the second aspect of the present
15 disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

With reference to the appended drawings, below follows a more detailed description of
20 embodiments of the invention cited as examples.

In the drawings:

Fig. 1 is a schematic side view of a vehicle;
25

Fig. 2 is a schematic side view of an embodiment of a bogie beam assembly;

Fig. 3 is a cross-sectional view of the Fig. 2 embodiment;

30 Fig. 4 is a schematic perspective view of another embodiment of a bogie beam assembly,
and

Fig. 5 is a schematic perspective view of a further embodiment of a bogie beam
assembly.

35

It should be noted that the appended drawings are not necessarily drawn to scale and that the dimensions of some features of the present invention may have been exaggerated for the sake of clarity.

5 DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The invention will be described in the following for a vehicle in the form of an articulated hauler 10 such as the one illustrated in Fig. 1. The articulated hauler 10 should be seen as an example of a vehicle which could comprise a suspension arrangement and/or a bogie beam assembly according to the present invention.

The vehicle 10 comprises a vehicle main body 12 having a vertical extension in a vertical direction V. Moreover, and as is indicated in Fig. 1, the vehicle main body 12 also has an extension in a longitudinal dimension L in the intended drive direction of the vehicle 10 and an extension in a transversal dimension T being perpendicular to each one of the vertical and longitudinal dimensions V, L.

The Fig. 1 vehicle 10 comprises a front vehicle portion 14 and a rear vehicle portion 16. The front and rear vehicle portions 14, 16 are connected to one another such that the front and rear vehicle portions can pivot relative to one another around a steering axis A_S extending substantially in the vertical dimension V and/or around a geometrical axis of rotation A_R extending substantially along the longitudinal dimension L. Each one of the vehicle portions 14, 16 forms part of the vehicle main body 12.

Moreover, the vehicle 10 comprises a plurality of wheels 18, 20, 22 each one of which is connected, directly or indirectly, to the vehicle main body 12. Moreover, the Fig. 1 vehicle 10 may comprises a bogie beam assembly 24. In the Fig. 1 embodiment of the vehicle 10, the bogie beam assembly 24 is connected to the rear vehicle portion 16 but in other embodiments, the front vehicle portion 14 may instead, or also, comprise a bogie system (not shown).

As used herein, the expression "vehicle main body 12" comprises all portions of the vehicle 10 except for the bogie beam assembly 24. The bogie beam assembly 24 is generally attached to a frame 25 of the vehicle 10, which frame 25 thus forms part of the

vehicle main body 12, but it is also envisaged that the bogie beam assembly 24 may be connected to another portion of the vehicle main body 12.

As may be gleaned from Fig. 1, the bogie beam assembly 24 comprises a plurality of
5 wheels 20, 22 and the bogie beam assembly 24 is such that each one of the wheels 20, 22 is allowed to be subjected to a relative vertical displacement in relation to the vehicle body 12. To this end, the bogie beam assembly 24 comprises a bogie beam 26 connecting the wheels 20, 22. The bogie beam 26 is pivotable around a bogie pivot axis 28 in relation to the vehicle main body 12 to thereby allow each one of the wheels 20, 22
10 to be subjected to a displacement in at least the vertical direction V, in relation to the vehicle main body 12.

Fig. 2 illustrates an embodiment of the bogie beam assembly 24. The Fig. 2 bogie beam assembly 24 comprises a bogie beam 26 and a suspension arrangement 30. Moreover,
15 the Fig. 2 bogie beam assembly 24 comprises a forward wheel joint 32 and a rearward wheel joint 34. Each one of the wheel joints 32, 34 is adapted to be connected to a wheel (not shown in Fig.2). The wheel joints 32, 34 are located on the bogie beam 26 on opposite sides of the suspension arrangement 30. As is indicated in Fig. 2, each one of the wheel joints 32, 34 may comprise suspension means.

20

It is also envisaged that embodiments of the bogie beam assembly 24 may comprise a bogie beam 26 comprising more than two wheel joints (not shown) and/or a wheel joint that may be adapted to be connected to more than one wheel (not shown).

25 As may be gleaned from Fig. 2, the suspension arrangement 30 comprises a connector 36 having a means for pivotally connecting the connector to the vehicle main body (not shown in Fig. 2) for pivoting around a substantially horizontal bogie pivot axis 28.

Purely by way of example, and as is indicated in the Fig. 2 embodiment, the suspension
30 arrangement 30 may comprise a connector body 40 and a bearing 42, such as a slide bearing or a roller bearing. As a non-limited example, the bearing 42 may be adapted to receive a shaft 43 of a vehicle such that the connector body 40 is pivotable around the vehicle shaft 43. In the above implementation, the connector 36 thus comprises the connector body 40 and the portion of the bearing 42 that is adapted to move with the
35 connector body 40.

As another non-limiting example, the suspension arrangement 30 may comprise a first connector body (not shown) and a second connector body (not shown) that are connected to one another via the bearing 42. In such an implementation, one of the first and second
5 connector bodies may be adapted to be fixedly attached to the vehicle main body.

It is also envisaged that the implementations of the connector 36 need not necessarily be furnished with a bearing in order to be pivotally connectable to the vehicle main body, e.g. a vehicle frame of the vehicle main body. Purely by way of example, such an
10 implementation may comprise a protrusion (not shown) such as a shaft (not shown) that is adapted to be received by a pivotable attachment arrangement (not shown), e.g. an arrangement comprising a bearing, of the vehicle main body.

The suspension arrangement 30 further comprises a resilient means 38 for connecting the
15 connector 30 and the bogie beam 26 to each other. Purely by way of example, the resilient means 38 may be fixedly connected to the connector 30, for instance by means of a joint, such as a weld joint or a bolt joint, or by means of an adhesive, such as glue. Moreover, and again purely by way of example, the resilient means 38 may be adapted to be connected to the bogie beam 26 by means of a joint, such as a weld joint or a bolt
20 joint, and/or by means of an adhesive, such as glue.

In the embodiment illustrated in Fig. 2, the resilient means comprises a first resilient member 44. Purely by way of example, the first resilient member 44 may comprise a spring, such as a helical spring. Fig. 2 further illustrates that the resilient means 38
25 comprises a second resilient member 46. As for the first resilient member, and again as a non-limiting example, the second resilient member 46 may comprise a spring, such as a helical spring.

In other embodiments, and as is illustrated in Fig. 4, each one of the first and second
30 resilient members 44, 46 may comprise a rubber spring, preferably a rubber shear spring. It is also envisaged that embodiments of the suspension arrangement 30 may comprise a single resilient member, e.g. a rubber spring, substituting both the resilient members in Fig. 2.

Fig. 2 further illustrates that the connector 36 has a connector extension in a connector direction 52. The connector direction 52 extends from a connector top portion 48 to a connector bottom portion 50. When the connector is connected to a vehicle (not shown) and the vehicle is positioned on a flat ground, the connector top portion 48 is the uppermost portion and the connector bottom portion 50 is the lowermost portion of the connector 36.

As indicated in Fig. 2, the vehicle a portion of which the connector 36 is adapted to be connected to may extend in a vertical direction V that is positive in a direction from the ground up towards the vehicle. Moreover, Fig. 2 illustrates that the connector direction 52 may substantially extend in a negative vertical direction when the connector 36 is connected to the vehicle main body.

As a non-limiting example, the first resilient member 44 may be adapted to extend from the connector 36 to the bogie beam 26 in a direction having a component V1 extending in the connector direction 52. In a similar vein, the second resilient member 46 may adapted to extend from the connector 36 to the bogie beam 26 in a direction having a component V2 extending in the connector direction 52. The above directions V1, V2 imply that the first resilient member 44 and/or the second resilient member 46 may be compressed, rather than being strained, during use.

Fig. 2 further illustrates that the first resilient member 44 may be adapted to extend from the connector 36 to the bogie beam 26 in a first direction having a component H1 extending in a first horizontal direction, perpendicular to the connector direction 52, and the second resilient member 46 may be adapted to extend from the connector 36 to the bogie beam 26 in a second direction having a component H2 extending in a second horizontal direction. The second horizontal direction is substantially opposite to the first horizontal direction.

Moreover, Fig. 2 illustrates that the bogie beam comprises a bogie beam abutment portion 54. The connector 36 has a connector abutment portion 56 which is adapted to abut the bogie beam abutment portion 54 when the resilient means 38 has been deformed to a predetermined extent.

As a non-limiting example, in order to increase the probability that the bogie beam assembly 24 may function at least as a traditional bogie beam without any resilient means in the case that the resilient means 38 is excessively deformed and/or the resilient means 38 does not function properly, the connector abutment portion 56 and the bogie beam abutment portion 54 are such that when the connector abutment portion 56 abuts the bogie beam abutment portion 54, at least two abutment points are obtained which are located at a distance from one another, e.g. on either side of the horizontal bogie pivot axis 28, see e.g. Fig. 5.

Fig. 2 illustrates a non-limiting implementation in which an abutment area is formed between the connector abutment portion 56 and the bogie beam abutment portion 54 when they are contacting one another. Such an abutment area comprises a plurality of abutment points which in turn implies an appropriate motion transfer between the connector 36 and the bogie beam 26.

15

Moreover, Fig. 2 illustrates that the bogie beam assembly 24 may comprise an initial gap G between the connector abutment portion 56 and the bogie beam abutment portion 54. The initial gap preferably being at least 10 millimetres, more preferred at least 30 millimetres, alternatively at least 40 millimetres. The initial gap G may be obtained in an unloaded condition of the vehicle. In a loaded condition of the vehicle, the resilient means 38 may be deformed to such an extent that the connector abutment portion 56 abuts the bogie beam abutment portion 54. As a non-limiting example, and as is indicated in Fig. 2, the gap G may be measured in the connector direction 52 which in turn may coincide with the negative vertical direction.

25

Moreover, as is indicated in Fig. 2, the bogie beam 26 may comprise a bogie beam cavity 58 delimited by a bogie beam cavity wall 60. As is indicated in Fig. 2, the bogie beam cavity wall 60 may comprise the bogie beam abutment portion 54. As is indicated in Fig. 2, bogie beam cavity 58 may be a through opening in the bogie beam 26. However, it is also envisaged that implementations of the bogie beam 26 may instead comprise an open recess (not shown) at least partially delimited by a recess wall comprising the bogie beam abutment portion 54.

Fig. 3 illustrates a cross-section of the Fig. 2 embodiment. Fig. 3 illustrates that the shaft 43 is connected to the bearing 42 such that the connector 36 is adapted to pivot around a

bogie pivot axis 28. The bogie pivot axis 28 illustrated in Fig. 3 is substantially horizontal. In fact, the bogie pivot axis 28 illustrated in Fig. 3 is substantially parallel to a line extending in the transversal dimension T. However, it is also envisaged that embodiments of the suspension arrangement 30 may comprise a connector 36 that is adapted to pivot
5 around a bogie pivot axis 28 that forms an angle with a line extending in the transversal dimension T. Purely by way of example, the bogie pivot axis 28 may extend in a direction that forms an angle of less than 30° , preferably less than 15° , with a line extending in the transversal dimension T. Instead of, or in addition, to the above, the bogie pivot axis 28 may extend in a direction that extends in a plane that is parallel to the plane formed by the
10 vertical and transversal dimensions V, T.

Purely by way of example, it is envisaged that such a bogie pivot axis 28 may comprise a component that extends in a negative vertical direction such that a bogie pivot axis 28' forms an angle α with a line extending in the transversal dimension T. Such an inclined
15 bogie pivot axis 28' is illustrated in the right portion of Fig. 3. A bogie pivot axis 28' extending in a direction with a component in the negative vertical direction implies that a wheel (not shown) connected to the bogie beam 26 will move outward from the vehicle when the wheel moves upwards, i.e. in a positive vertical direction. This in turn implies that a relatively large vertical displacement of a wheel may be obtained without interfering
20 with other vehicle parts.

Fig. 4 illustrates another embodiment of a bogie beam assembly 24. As compared to the Fig. 2 embodiment, the first and second resilient members 44, 46 of the Fig. 4 embodiment extend in a more horizontal direction. In the Fig. 2 embodiment, each one of
25 the first and second resilient members 44, 46 forms an angle of approximately 45° with a plane formed by the longitudinal and transversal dimensions L, T whereas the corresponding angle is approximately 15° for each one of the first and second resilient members 44, 46 in the Fig. 4 embodiment. As such, in the Fig. 4 embodiment, the suspension of the resilient means is at least partly obtained by shearing of the first and
30 second resilient members 44, 46. Moreover, the Fig. 4 embodiment is illustrated in a condition with a relatively low load, e.g. an unloaded condition, i.e. the vehicle to which the Fig. 4 bogie beam assembly 24 is connected is in a condition with a relatively low load. As such, if the vehicle is loaded further, the connector may move downwards relative to the bogie beam. For a high vehicle load for instance, an abutment portion of the
35 connector may abut a bogie beam abutment portion.

Fig. 5 illustrates a further embodiment of a bogie beam assembly 24. As compared to the Fig. 2 – Fig. 4 embodiments, the resilient means 38 of the Fig. 5 embodiment only comprises a one resilient member 44 which resilient member in Fig. 5 is exemplified by a spring such as a helical spring. However, it is also envisaged that the Fig. 5 resilient means instead, or in addition, may comprise another type of resilient member such as a rubber element (not shown). The Fig. 5 connector 36 is located in a beam cavity 58 delimited by a bogie beam cavity wall 60.

- 10 In order to ensure small relative motions at least along the longitudinal dimension L between the connector 36 and the bogie beam 26, a relatively small play P along the longitudinal dimension L may be provided between the connector 36 and the bogie beam 26, viz by the connector 36 and the bogie beam cavity wall 60. As a non-limiting example, the play P may be less than one millimetre on either side of the connector 36. It is also
15 envisaged that the play P may be substantially zero and that portions of the connector 36 and portions of the bogie beam cavity wall 60 form slide surfaces allowing the connector 36 to move in at least the vertical direction relative to the bogie beam 26.

Further, in the Fig. 5 embodiment, the connector comprises a connector abutment portion
20 56 and the bogie beam 26 comprises a bogie beam abutment portion 54 which in turn comprises two sub-portions 54', 54''. The sub-portions 54', 54'' are located on either side of the resilient member 44 in the longitudinal dimension L. As such, when the connector abutment portion 56 abuts the sub-portions 54', 54'', at least two abutment points, or alternatively at least two abutment areas, are obtained which are located at a distance
25 from one another, e.g. on either side of the horizontal bogie pivot axis 28, see e.g. Fig. 5.

It is to be understood that the present invention is not limited to the embodiments described above and illustrated in the drawings; rather, the skilled person will recognize that many changes and modifications may be made.

CLAIMS

1. A suspension arrangement (30) for a bogie beam (26) for a vehicle (10),
comprising a connector (36) having a means for pivotally connecting the connector
(36) to a vehicle main body (12) for pivoting around a substantially horizontal bogie
5 pivot axis (28), characterized in that said suspension arrangement (30)
further comprises a resilient means (38) for connecting said connector (36) and
said bogie beam (26) to each other.
2. The suspension arrangement (30) according to claim 1, comprising a bearing (42),
10 such as a slide bearing or a roller bearing, at least a portion of which forming part
of said means for pivotally connecting the connector (36) to the vehicle main body
(12).
3. The suspension arrangement (30) according to any one of the preceding claims,
15 wherein said resilient means (38) comprises a first resilient member (44).
4. The suspension arrangement (30) according to claim 3, wherein said first resilient
member (44) comprises a rubber spring, preferably a rubber shear spring.
- 20 5. The suspension arrangement (30) according to any one of claim 3 or claim 4,
wherein said resilient means (38) comprises a second resilient member (46).
6. The suspension arrangement (30) according to claim 5, wherein said second
resilient member (46) comprises a rubber spring, preferably a rubber shear spring.
25
7. The suspension arrangement (30) according to any one of claim 3 to claim 6,
wherein said connector (36) has a connector extension in a connector direction
(52), said connector direction extending from a connector top portion to a
connector (36) bottom portion (26).
30
8. The suspension arrangement (30) according to claim 7, wherein said vehicle (10)
extends in a vertical direction (V) that is positive in a direction from the ground up
towards said vehicle (10), said connector direction (52) substantially extending in a
negative vertical direction when said connector (36) is connected to said vehicle
35 main body (12).

9. The suspension arrangement (30) according to claim 7 or 8, wherein said first resilient member (44) is adapted to extend from said connector (36) to said bogie beam (26) in a direction having a component extending in said connector direction (52).
5
10. The suspension arrangement (30) according any one of claims 7 to 9, when dependent on claim 5, wherein said second resilient member (46) is adapted to extend from said connector (36) to said bogie beam (26) in a direction having a component extending in said connector direction (52).
10
11. The suspension arrangement (30) according to any one of claims 7 to 10, when dependent on claim 5, wherein said first resilient member (44) is adapted to extend from said connector (36) to said bogie beam (26) in a first direction having a component (H1) extending in a first horizontal direction, perpendicular to said connector direction (52), and said second resilient member (46) extends from said connector (36) to said bogie beam (26) in a second direction having a component (H2) extending in a second horizontal direction, said second horizontal direction being substantially opposite to said first horizontal direction.
15
20
12. A bogie beam assembly comprising a bogie beam (26) and a suspension arrangement (30) according to any one of the preceding claims, said resilient means (38) connecting said connector (36) to said bogie beam (26).
25
13. The bogie beam assembly (24) according to claim 12, wherein said bogie beam (26) comprises a bogie beam abutment portion (54), wherein said connector (36) has a connector abutment portion (56) which is adapted to abut a portion of said bogie beam abutment portion (54) when said resilient means (38) has been deformed to a predetermined extent.
30
14. The bogie beam assembly (24) according to claim 13, wherein said bogie beam assembly (24) comprises an initial gap (G) between said connector abutment portion (56) and said bogie beam abutment portion (56), said initial gap (G) preferably being at least 10 millimetres, more preferred at least 30 millimetres, alternatively at least 40 millimetres.
35

15. The bogie beam assembly (24) according to any one of claims 13 to 14, wherein said bogie beam (26) comprises a bogie beam cavity (58) delimited by a bogie beam cavity wall (60), preferably said a bogie beam cavity wall (60) comprising said bogie beam abutment portion (54).
- 5
16. A vehicle (10), preferably an articulated hauler, comprising a suspension arrangement (30) according to any one of claims 1 – 11 and/or a bogie beam assembly (24) according to any one of claims 12 – 15.

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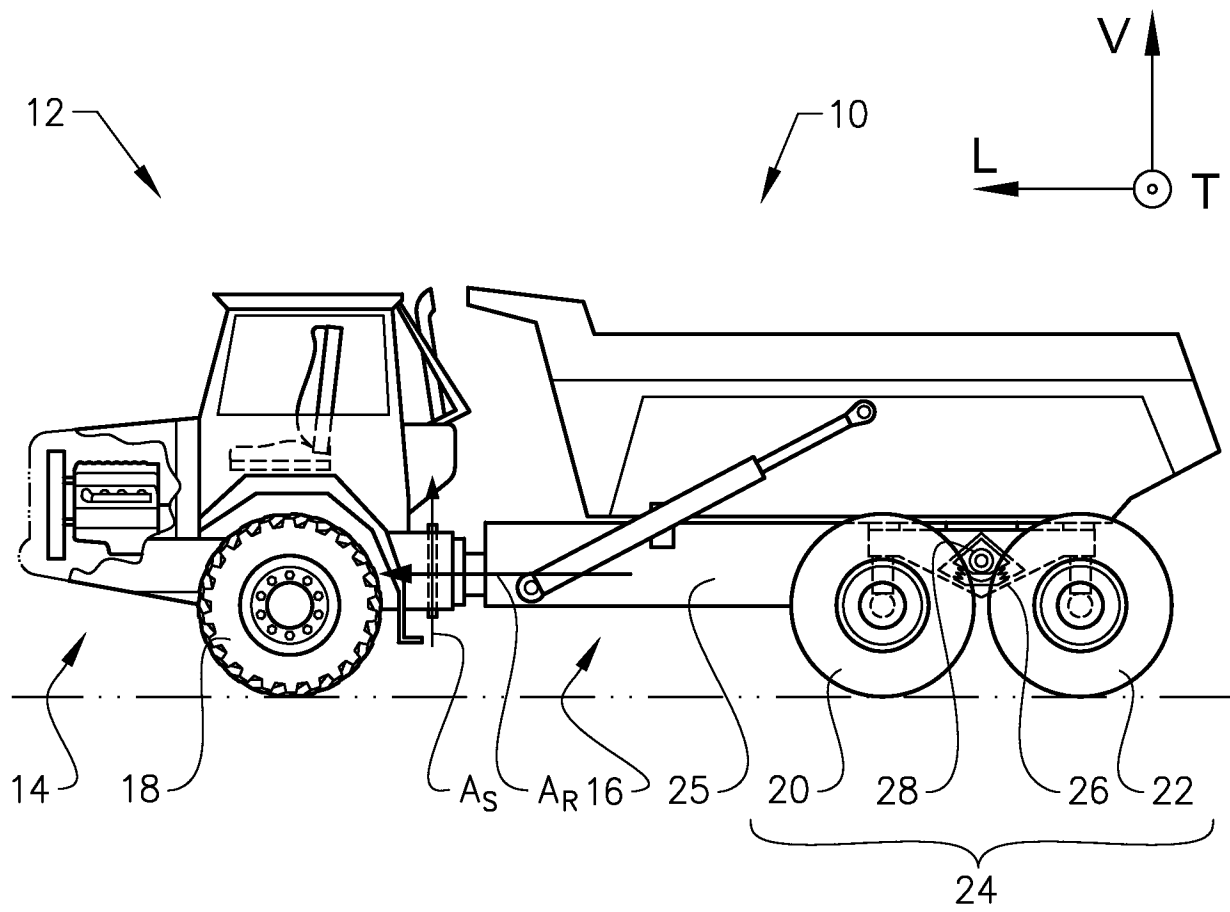


FIG. 1

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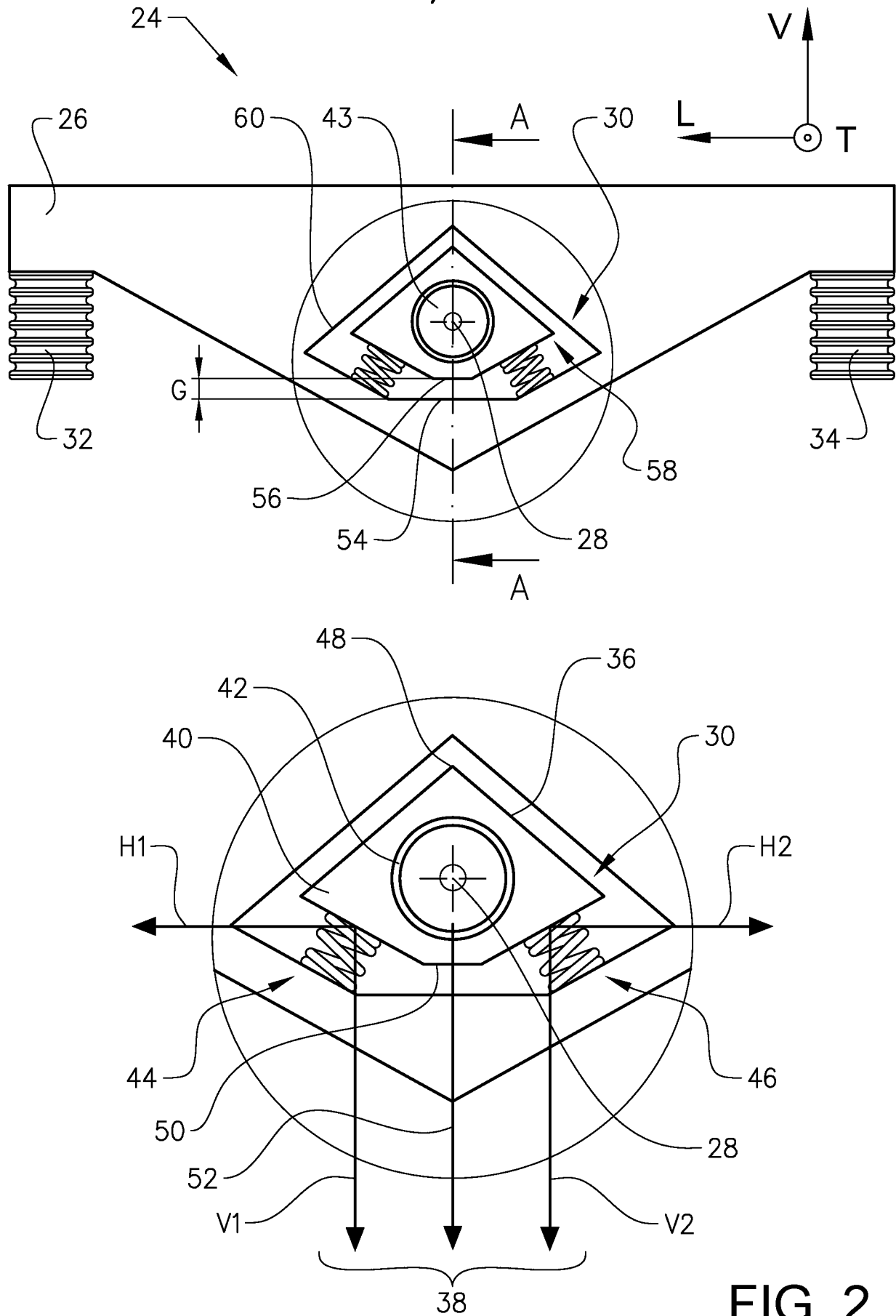


FIG. 2

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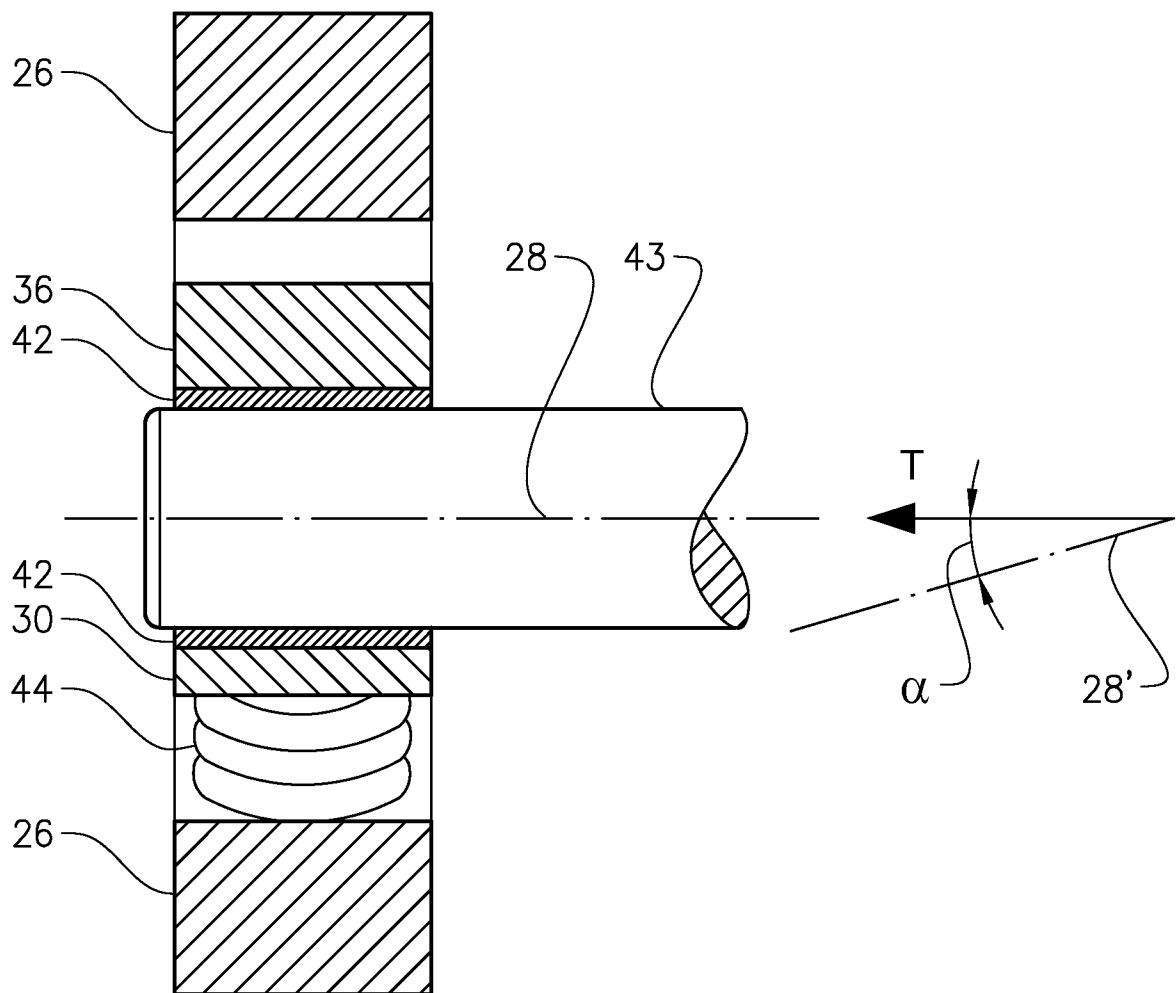


FIG. 3 A-A

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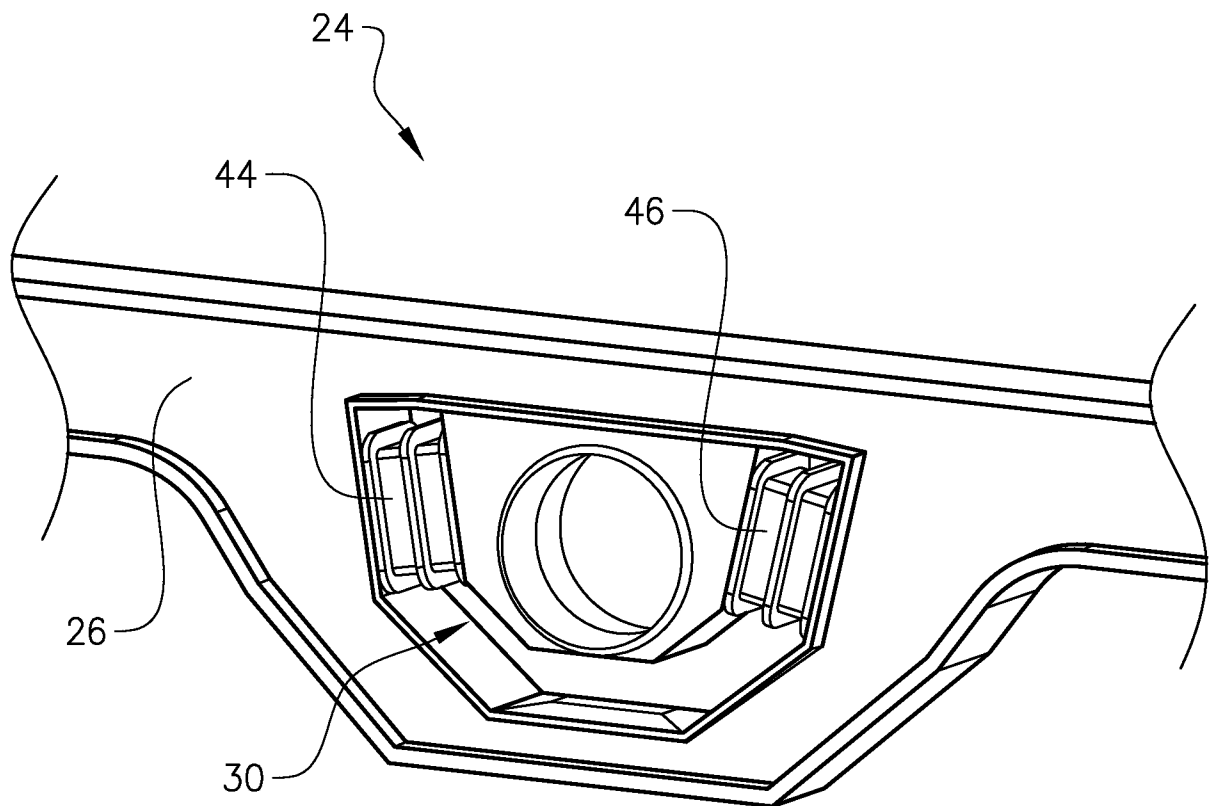


FIG. 4

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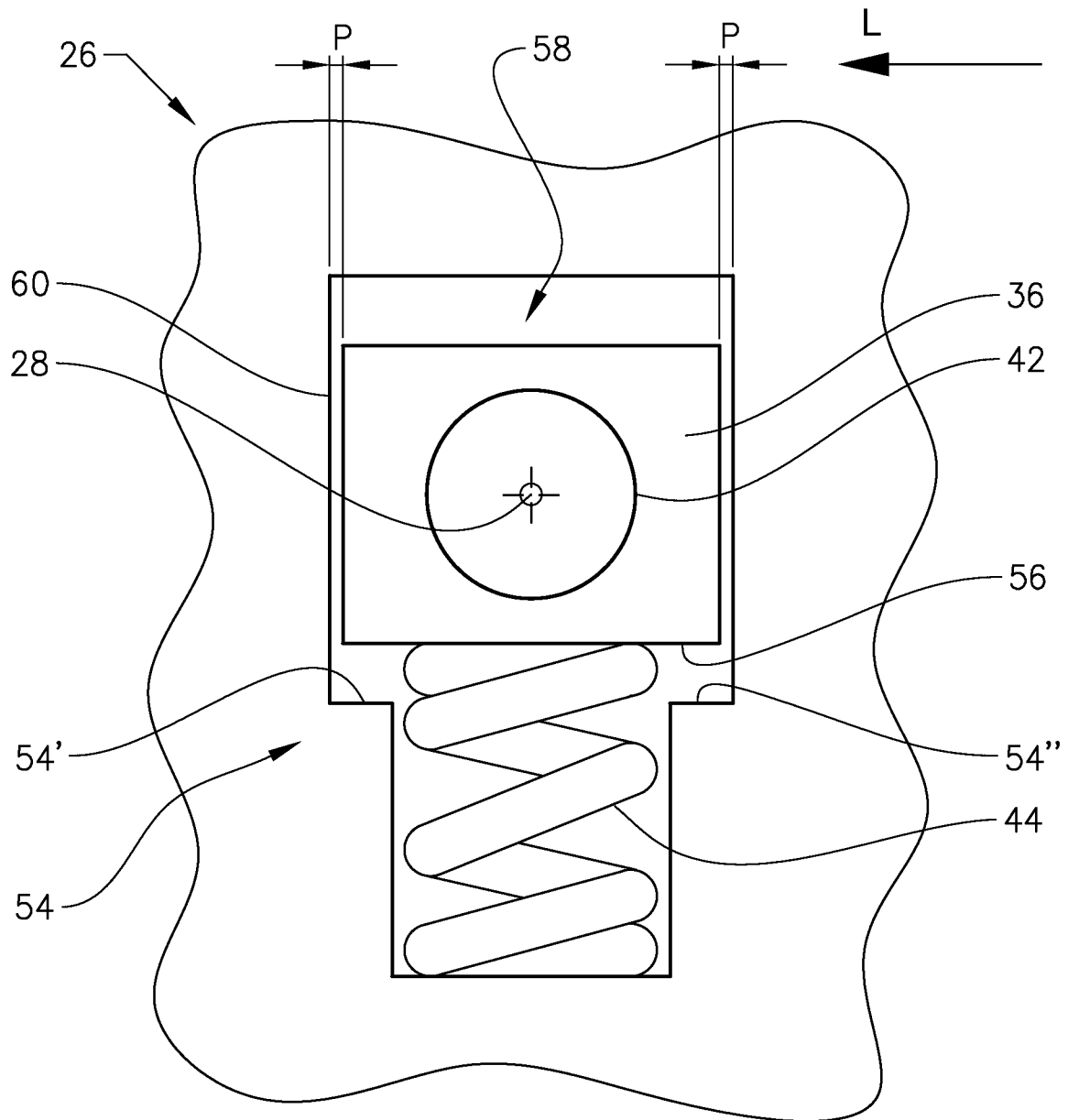


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2015/050691

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

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: B60G, E02F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, PAJ, WPI data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2349466 A1 (GOULD INC), 25 November 1977 (1977-11-25); whole document --	1-16
A	US 2360619 A (PETERMAN THEODORE A), 17 October 1944 (1944-10-17); whole document --	1-16
A	EP 0021819 A1 (DUNLOP LTD), 7 January 1981 (1981-01-07); whole document --	1-16
A	US 2754132 A (MARTIN WILLIAM E), 10 July 1956 (1956-07-10); whole document --	1-16



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance

“E” earlier application or patent but published on or after the international filing date

“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

09-02-2016

Date of mailing of the international search report

09-02-2016

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2015/050691

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2009148588 A1 (MINER ENTERPRISES), 10 December 2009 (2009-12-10); whole document; claims -- -----	1-16

Continuation of: second sheet
International Patent Classification (IPC)
B60G 5/02 (2006.01)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/SE2015/050691

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			GB	1571692 A	16/07/1980
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