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(54) **A DETECTION DEVICE FOR A RAILWAY VEHICLE**

(57) The detection device (10) is intended to detect an event chosen between an obstacle on the track and/or a derailment of the railway vehicle, and is intended to be arranged on a leading bogie of a leading car of the railway vehicle. The detection device (10) comprises:
- a transverse beam (14) intended to be connected to the leading bogie (12) by means of connection means, and

- force detection means (26), arranged and configured to measure a force in at least one direction.

The connection means has no degree of freedom, so that the transverse beam (14) is intended to be fixedly connected to the leading bogie, and the force detection means (26) comprise at least one load cell (28, 30) fixedly connected to the transverse beam (14).

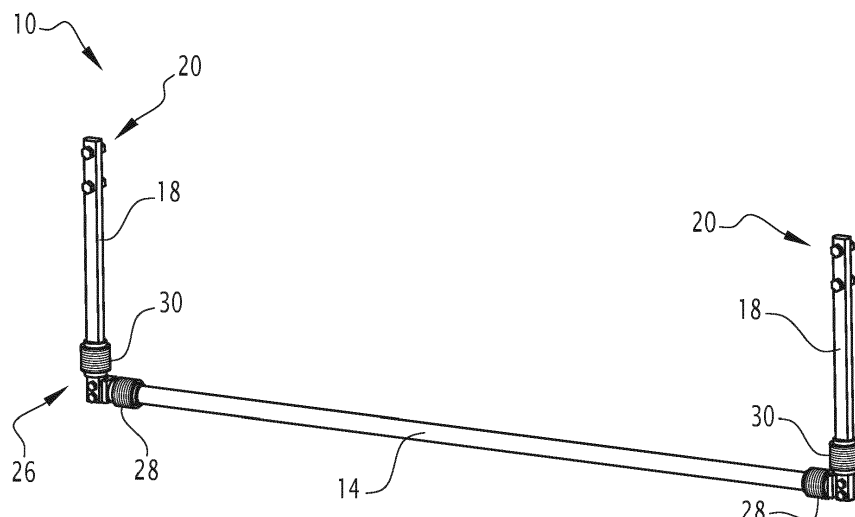


FIG.2

Description

[0001] The present invention concerns a detection device for a railway vehicle circulating on a track, intended to detect an event chosen between an obstacle on the track and/or a derailment of the railway vehicle.

[0002] Some detection devices are already known from prior art. Known detection devices usually comprise a transverse beam intended to be arranged in front of the railway vehicle. This transverse beam is movable, and the detection device comprises a sensor able to detect when the transverse beam moves. Indeed, the transverse beam moves as a result of an event such as coming in contact with an obstacle on the track.

[0003] Such a detection device comprises a lot of components, particularly some moving parts.

[0004] The invention aims to simplify the structure of a detection device, so as to reduce its cost and the duration of its mounting on the vehicle, without reducing its efficiency.

[0005] To this end, the invention relates to a detection device for a railway vehicle circulating on a track, intended to detect an event chosen between an obstacle on the track and/or a derailment of the railway vehicle, and intended to be arranged on a leading bogie of a leading car of the railway vehicle, the detection device comprising:

- a transverse beam intended to be connected to the leading bogie by means of connection means, and
- force detection means, arranged and configured to measure a force in at least one direction,

wherein:

- the connection means has no degree of freedom, so that the transverse beam is intended to be fixedly connected to the leading bogie,
- the force detection means comprise at least one load cell fixedly connected to the transverse beam.

[0006] The use of load cells allows using a fixed transverse beam, i.e. having no degree of freedom. On the contrary, detection devices from prior art need a transverse beam mounted with at least one degree of freedom (usually in rotation).

[0007] As a result, the structure of the detection device of the invention is much more simple than the structure of a detection device from prior art.

[0008] A detection device according to the invention can optionally contain one or more of following features.

- The connection means comprise at least one support bracket, fixedly connected to the transverse beam, and intended to be fixedly connected to the leading bogie, and the transverse beam is connected to the support bracket via a component made of a resilient material.

- The force detection means comprise at least a first load cell, arranged and configured to measure longitudinal forces on the transverse beam, in a vertical direction perpendicular to the transverse beam, the first load cell being fixedly connected to the transverse beam.
- The first load cell is able to send a trigger signal to an Emergency brake circuit of the railway vehicle, the first load cell being configured to send the trigger signal when the first load cell measures a vertical force superior than a first threshold.
- The first threshold is 100 DaN.
- The connection means comprise at least one support bracket, fixedly connected to the transverse beam, and intended to be fixedly connected to the leading bogie, the first load cell being arranged between the transverse beam and the support bracket.
- The force detection means comprise a second load cell, arranged and configured to measure vertical forces on the transverse beam, in a longitudinal direction perpendicular to the transverse beam, the second load cell being fixedly connected to the transverse beam.
- The second load cell is able to send a trigger signal to an Emergency brake circuit of the railway vehicle, the second load cell being configured to send the trigger signal when the second load cell measures a longitudinal force superior than a second threshold.
- The second threshold is 500 DaN.
- The connection means comprise at least one support bracket, fixedly connected to the transverse beam, and intended to be fixedly connected to the leading bogie, the second load cell being arranged on the support bracket.

[0009] The invention also relates to a railway vehicle, having a leading bogie, wherein the railway vehicle comprises a detection device as previously disclosed, fixedly connected to the leading bogie.

[0010] Other aspects and advantages of the invention will now be shown in the following specification, given only as a non-limitative example, and made in view of annexed drawings, in which:

- Figure 1 is a perspective view of a detection device according to a first embodiment of the invention, mounted on a bogie of a railway vehicle.
- Figure 2 is a perspective view of the detection device of Figure 1, showing more details,
- Figure 3 is an exploded view of a detail of the detection device of Figure 2.
- Figure 4 is a perspective view of a detail of a detection device according to a second embodiment,
- Figure 5 is a perspective view of a detail of a detection device according to a third embodiment, and
- Figure 6 is a perspective view of a detection device according to a fourth embodiment.

[0011] A detection device 10 according to a first embodiment is shown on Figures 1 and 2.

[0012] The detection device 10 is intended to be arranged on a leading bogie 12 of a leading car of a railway vehicle. The railway vehicle is intended to circulate on rail tracks.

[0013] The detection device 10 is intended to detect an event chosen between: an impact on an obstacle on the tracks and/or a derailment.

[0014] The detection device 10 comprises a transverse beam 14 intended to be connected to the leading bogie 12 by means of connection means 16. The transverse beam 14 extends in a transverse direction Y of the vehicle, between two ends. The transverse beam 14 is preferably straight, but in a variant it can be incurved or it can comprise two straight parts forming an angle.

[0015] In the specification, we consider a longitudinal direction X of the railway vehicle, which is the direction in which the railway vehicle extends, and the direction in which the railway vehicle moves. We also consider the transverse direction Y, which is perpendicular to the longitudinal direction X. We also consider a vertical direction Z, which is perpendicular to the longitudinal direction X and perpendicular to the transverse direction Y. Thus, the wordings "longitudinal", "transverse" and "vertical" have their usual meaning.

[0016] As shown on Figure 2, the connection means 16 comprise at least one support bracket 18. More particularly, in the example shown, the connection means 16 comprise two support brackets 18, each support bracket 18 being connected to a respective end of the transverse beam 14.

[0017] Each support bracket 18 extends in the vertical direction Z, between a lower end connected to the transverse beam 14, and an upper end intended to be connected to the bogie 12.

[0018] The upper end of each support bracket 18 comprises fixation means 20, for instance comprising screws. Thus, the support bracket 18 is intended to be fixedly connected to the bogie 12, by means of the fixation means 20.

[0019] By "fixedly connected", it is meant that there is no degree of freedom between the support bracket 18 and the bogie 12.

[0020] The transverse beam 14 is also fixedly connected to each support bracket 18. In other words, there is no degree of freedom between the support bracket 18 and the transverse beam 14.

[0021] The connection means 16 are shown with more details on figure 3. The connection means 16 comprise a rigid connection member 22 arranged between the support bracket 18 and the transverse beam 14. The connection member 22 is fixedly connected to the support bracket 18, for instance by screwing. Besides, the connection member 22 comprises a rod 22a intended to be fitted in a corresponding hole of the transverse beam 14. For instance, the transverse beam 14 is tubular, and said hole is concentric with the transverse beam 14.

[0022] Advantageously, a damping sleeve 24 is arranged between the rod 22a and the corresponding hole in the transverse beam 14. The damping sleeve 24 is made of a resilient material, so that it is able to absorb vibrations of the transverse beam 14. The damping sleeve 24 is also intended to compensate the bogie frame twist, and to compensate manufacturing tolerances.

[0023] It should be noticed that the transverse beam 14 is still considered as fixedly connected to each support bracket 18, even in the presence of the damping sleeve 24, because the damping sleeve 24 does not allow the transverse beam 14 to freely move in any direction.

[0024] The detection device 10 also comprises force detection means 26, arranged and configured to measure a force in at least one direction. The force detection means 26 comprise at least one load cell configured to measure forces in a direction.

[0025] In conformity with the first embodiment, the force detection means 26 comprise at least one first load cell 28 and at least one second load cell 30. More particularly, the force detection means 26 comprise two first load cells 28 and two second load cells 30.

[0026] Each load cell 28, 30 comprises, in a conventional manner, a respective strain gauge, able to measure the force applied to the transverse beam 14.

[0027] Each first load cell 28 is arranged and configured to measure vertical forces on the transverse beam 14, in the vertical direction Z. Each first load cell 28 is fixedly connected to the transverse beam 14.

[0028] For instance, each first load cell 28 is arranged at one respective end of the transverse beam 14. More particularly, as shown on figure 3, each first load cell 28 is arranged around one respective end of the rigid connection member 22.

[0029] Each second load cell 30 is arranged and configured to measure longitudinal forces on the transverse beam 14, in the longitudinal direction X. Each second load cell 30 is fixedly connected to the transverse beam 14.

[0030] For instance, each second load cell 30 is arranged around one respective support bracket 16, just above the connection between the support bracket 16 and the connection member 22.

[0031] Each load cell 28, 30 is able to send a trigger signal to an Emergency brake circuit of the railway vehicle. The Emergency brake circuit is well known from prior art.

[0032] The first load cell 28 is configured to send the trigger signal when it measures a vertical force superior than a first threshold. The second load cell 30 is configured to send the trigger signal when it measures a longitudinal force superior than a second threshold.

[0033] Preferably, the first threshold is 100 DaN, and the second threshold is 500 DaN.

[0034] Thus, the detection device 10 according to the first embodiment is able to detect two different events on the track, which are: an obstacle on the track between the rails, and a derailment.

[0035] For an obstacle detection, the principle established here is to detect an obstacle with an impact force of above the first threshold (100 daN) on the transverse beam 14 that is arranged in front of the lead bogie 12 of the railway vehicle. In case of such an impact, the transverse beam 14 tends to push backwards by the obstacle, and this introduces a reaction force on the second load cells 30. This reaction force is the trigger signal for the Emergency brake circuit.

[0036] In a variant, emergency brakes are activated when a trigger signal is received from both second load cells 30. For example, the trigger signal is received by average force from both the second load cells 30.

[0037] In another variant, only one trigger signal received from one of the second load cells 30 is sufficient for activating the emergency brakes.

[0038] For a derailment detection, the principle established here is to detect a derailment with an impact force of above the second threshold (500 daN) on the transverse beam 14 that is arranged in front of the lead bogie 12 of the railway vehicle. In this case, the wheel of the bogie climbs the rail and then jumps down the rail, so that the transverse beam 14 impacts on the rail and is pushed upwards by the rail, and this introduces a reaction force on the first load cells 28. This reaction force is the trigger signal for the Emergency brake circuit.

[0039] In a variant, emergency brakes are activated when a trigger signal is received from both first load cells 28. For example, the trigger signal is received by average force from both the first load cells 28.

[0040] In another variant, only one trigger signal received from one of the first load cells 28 is sufficient for activating the emergency brakes.

[0041] In a preferred variant, the fact that the force measured by a load cell 28, 30 exceeds the corresponding threshold is not a sufficient condition to send the trigger signal, but another condition should also be met. This other condition relates to the slope of the measured force, which should be above a predefined slope threshold to send the trigger signal. This variant is intended to handle the case of snow on the tracks.

[0042] Indeed, in case of snow on the tracks, the transverse beam 14 can run through the snow, so that the load cells 28, 30 measure a resistance force due to the snow. This resistance force has a gradual slope depending on the type and the quantity of snow and on the speed of the railway vehicle. This slope due to snow is usually a gentle increasing slope, thus a slope inferior to the slope threshold. Thus, by taking the slope into account, the emergency brakes are not activated because of snow on the tracks.

[0043] On the contrary, in case of an impact on an obstacle or in case of a derailment, the slope is very steep and high, thus the slope is superior to the slope threshold.

[0044] Thus, by taking the slope into account, it is made sure that the emergency brake is not activated because of the snow, but only because of a real obstacle or because of a derailment.

[0045] A detection device according to a second embodiment is shown on figure 4. On this figure, all components similar as those of the first embodiment are designated by the same reference numbers.

[0046] In conformity with this second embodiment, the detection device 10 only comprises the first load cell 28, and does not comprise the second load cell 30. Thus, this detection device 10 is only designed to detect derailments, but it cannot detect obstacles on the tracks.

[0047] A detection device according to a third embodiment is shown on figure 5. On this figure, all components similar as those of the first embodiment are designated by the same reference numbers.

[0048] In conformity with this third embodiment, the detection device 10 only comprises the second load cell 30, and does not comprise the first load cell 28. Thus, this detection device 10 is only designed to detect obstacles on the tracks, but it cannot detect derailments.

[0049] A detection device according to a fourth embodiment is shown on figure 6. On this figure, all components similar as those of the other embodiments are designated by the same reference numbers.

[0050] In conformity with this fourth embodiment, the transverse beam 14 comprises a first central part 14a and two second lateral parts 14b. Thus, the transverse beam 14 is a solid bar bent in a U shape without any joint, reducing further the number of components.

[0051] The first central part 14a extends in the transverse direction Y, and each second lateral part 14b extends in the vertical direction Z. The first central part 14a is connected to each second lateral part 14b via respective transitional incurved parts 14c.

[0052] The upper end of each second lateral part 14b comprises the fixation means 20, for instance comprising screws. Thus, each second lateral part 14b is intended to be fixedly connected to the bogie 12, by means of the fixation means 20. Indeed, the second lateral parts 14b have the same function as the support bracket 28 of the first embodiment.

[0053] By "fixedly connected", it is meant that there is no degree of freedom between the each second lateral part 14b and the bogie 12.

[0054] The first 28 and second 30 load cells are arranged around the second lateral parts 14b. More particularly, each second lateral parts 14b is provided with respective first 28 and second 30 load cells.

[0055] The first load cell 28 comprises strain gauges oriented so as to measure forces in the vertical direction Z. Besides, the second load cell 30 comprises strain gauges oriented so as to measure forces in the longitudinal direction X.

[0056] The functioning of this detection device 10 is the same as the functioning of the detection device according to the first embodiment.

[0057] It should be noticed that some variants can be considered. More particularly, the detection device can have only first load cells 28 as in the third embodiment, or only second load cells 30 as in the first embodiment.

[0058] The detection device 10 according to the fourth embodiment has less components than the detection device according to the first embodiment, thus it has less risks of failure.

[0059] It should be noticed that the invention is not limited to the embodiments above, but it could have various other variants.

Claims

1. A detection device (10) for a railway vehicle circulating on a track, intended to detect an event chosen between an obstacle on the track and/or a derailment of the railway vehicle, and intended to be arranged on a leading bogie (12) of a leading car of the railway vehicle, the detection device (10) comprising:

- a transverse beam (14) intended to be connected to the leading bogie (12) by means of connection means (16), and
- force detection means (26), arranged and configured to measure a force in at least one direction,

wherein:

- the connection means (16) has no degree of freedom, so that the transverse beam (14) is intended to be fixedly connected to the leading bogie (12),
- the force detection means (26) comprise at least one load cell (28, 30) fixedly connected to the transverse beam (14).

2. The detection device (10) according to claim 1, wherein the connection means (16) comprise at least one support bracket (18), fixedly connected to the transverse beam (14), and intended to be fixedly connected to the leading bogie (12), and the transverse beam (14) is connected to the support bracket (18) via a component (24) made of a resilient material.

3. The detection device (10) according to claim 1 or 2, wherein the force detection means (26) comprise at least a first load cell (28), arranged and configured to measure longitudinal forces on the transverse beam, in a vertical direction (Z) perpendicular to the transverse beam (14), the first load cell (28) being fixedly connected to the transverse beam (14).

4. The detection device (10) according to claim 3, wherein the first load cell (28) is able to send a trigger signal to an Emergency brake circuit of the railway vehicle, the first load cell (28) being configured to send the trigger signal when the first load cell (28) measures a vertical force superior than a first threshold.

old.

5. The detection device (10) according to claim 4, wherein the first threshold is 100 DaN.

6. The detection device according to claim 5, wherein the connection means (16) comprise at least one support bracket (18), fixedly connected to the transverse beam (14), and intended to be fixedly connected to the leading bogie (12), the first load cell (28) being arranged between the transverse beam (14) and the support bracket (18)

7. The detection device (10) according to any of preceding claims, wherein the force detection means (26) comprise a second load cell (30), arranged and configured to measure vertical forces on the transverse beam (14), in a longitudinal direction (X) perpendicular to the transverse beam (14), the second load cell (30) being fixedly connected to the transverse beam.

8. The detection device (10) according to claim 7, wherein the second load cell (30) is able to send a trigger signal to an Emergency brake circuit of the railway vehicle, the second load cell (30) being configured to send the trigger signal when the second load cell (30) measures a longitudinal force superior than a second threshold.

9. The detection device according to any of claims 7 to 8, wherein the connection means (16) comprise at least one support bracket (18), fixedly connected to the transverse beam (14), and intended to be fixedly connected to the leading bogie (12), the second load cell (30) being arranged on the support bracket (18).

10. A railway vehicle, having a leading bogie (12), wherein the railway vehicle comprises a detection device according to any of preceding claims, fixedly connected to the leading bogie (12).

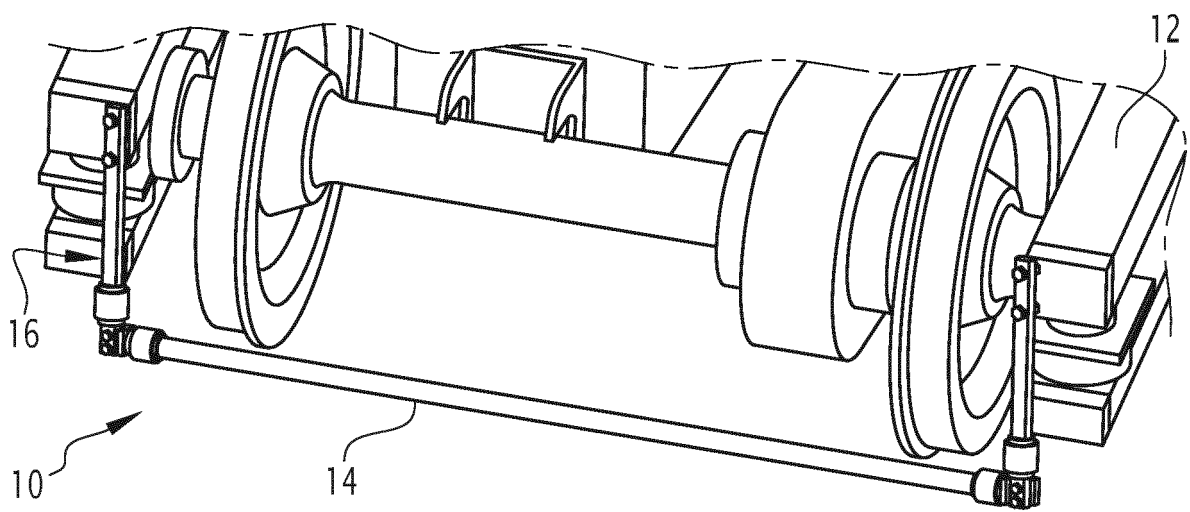


FIG.1

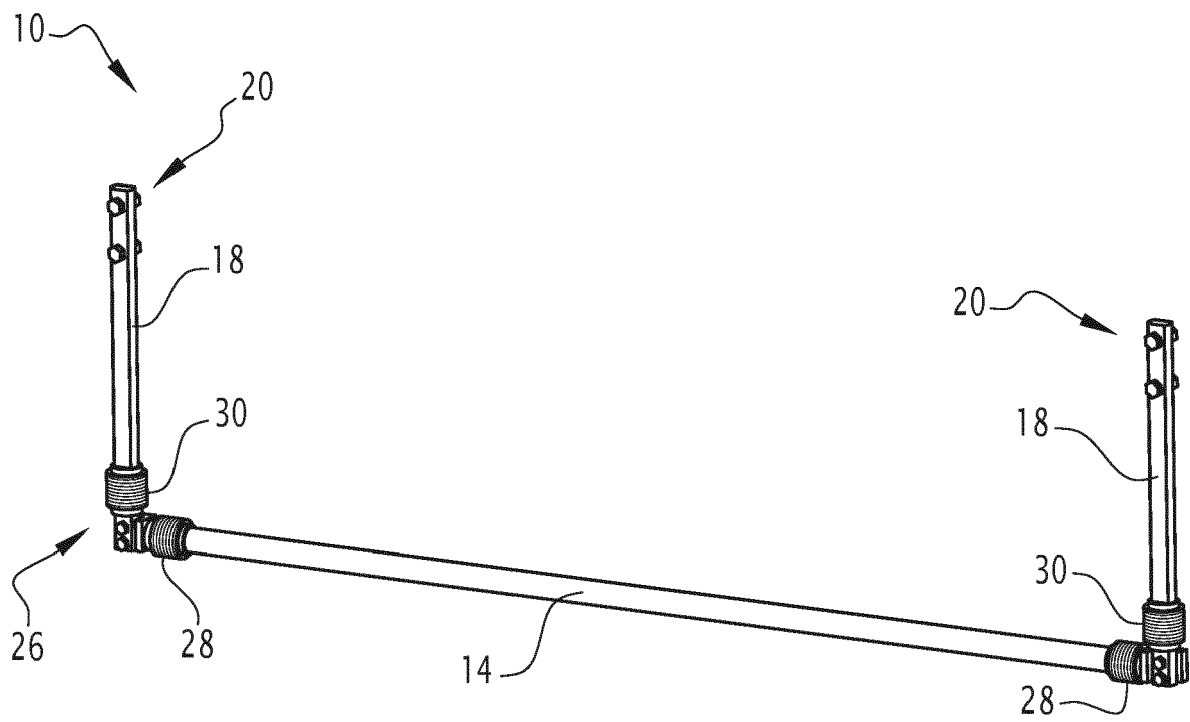


FIG.2

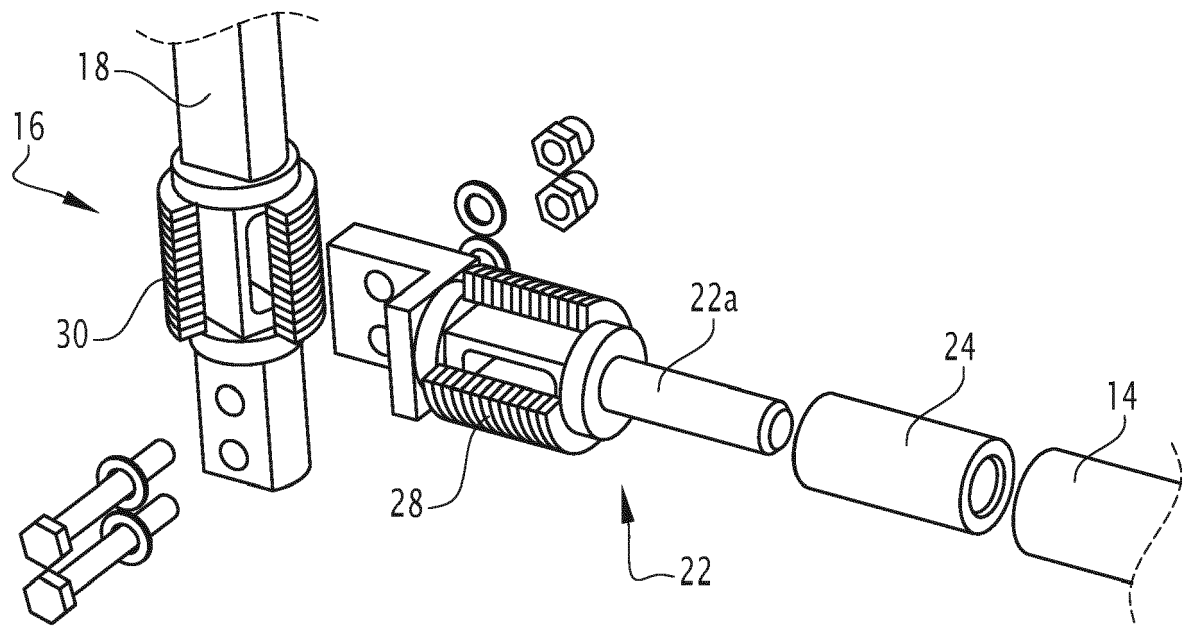


FIG.3

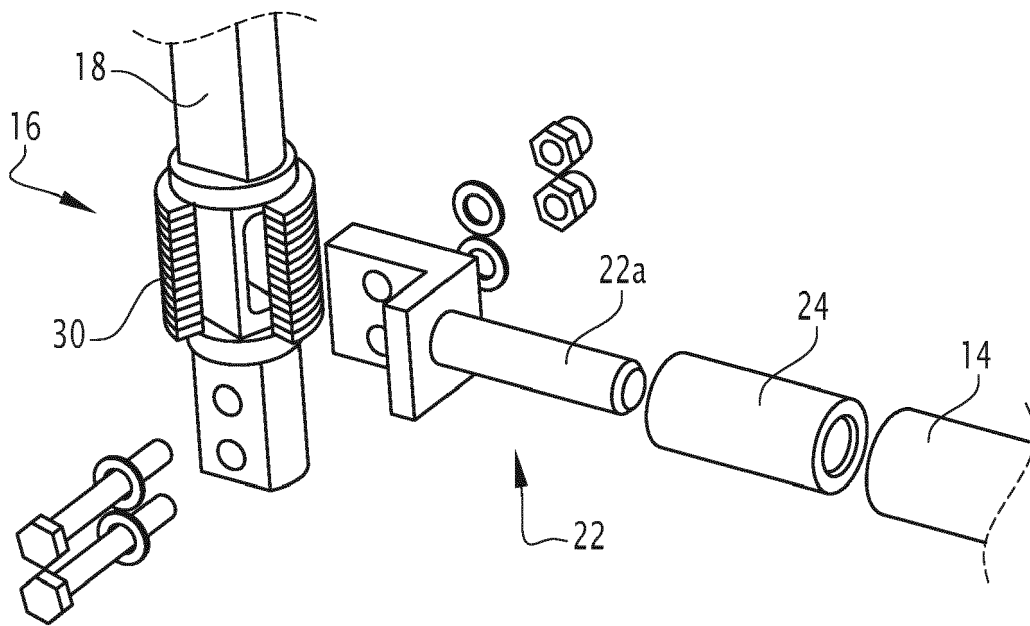


FIG.4

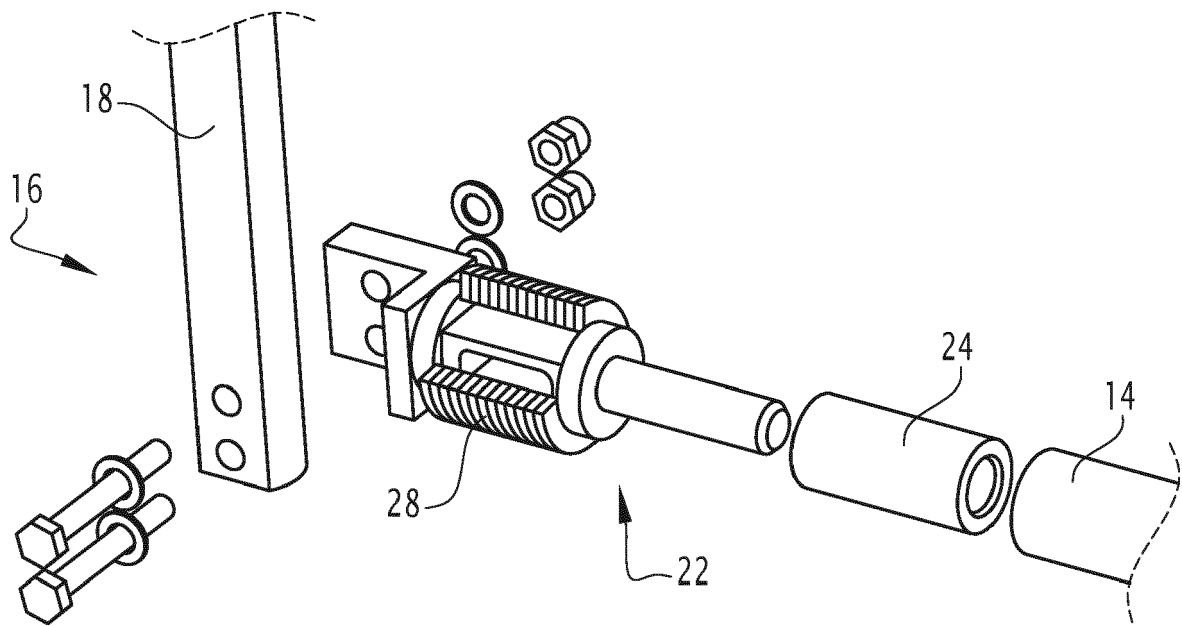


FIG.5

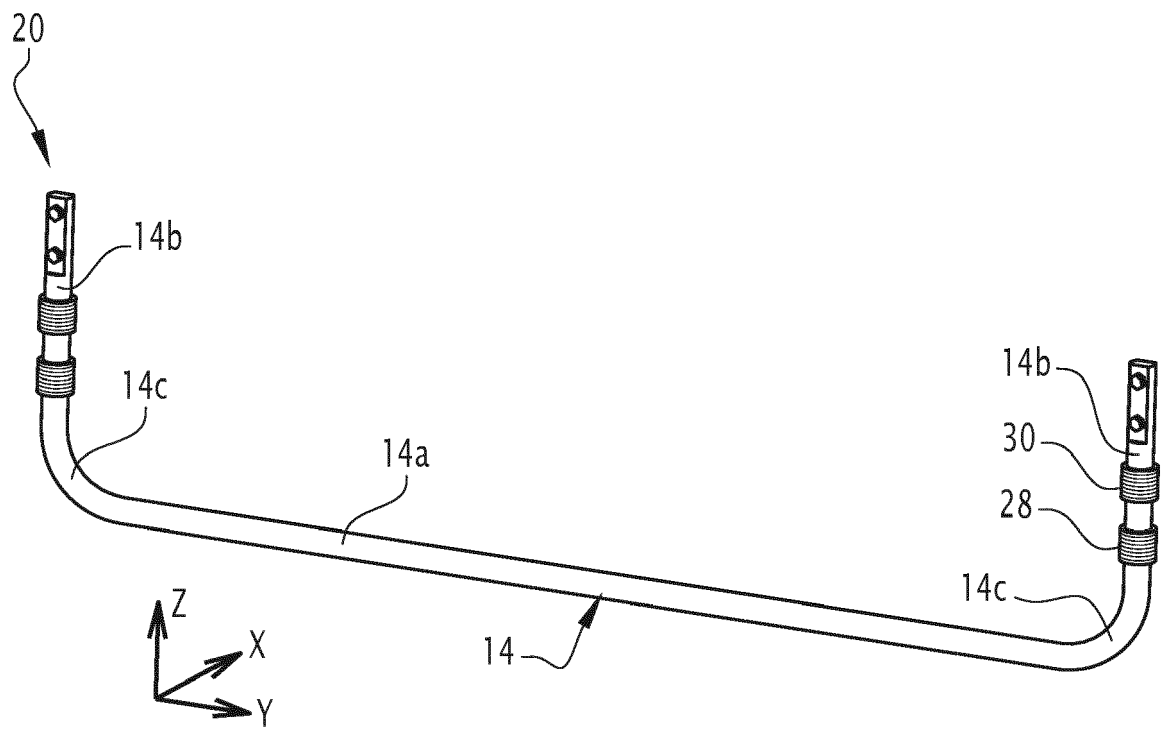


FIG.6



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Application Number
EP 20 19 5325

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 21 January 2021	Examiner Awad, Philippe
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