(19) DANMARK

(10) **DK/EP 3059137 T3**

Patent- og Varemærkestyrelsen

(12) Oversættelse af europæisk patentskrift

(51) Int.Cl.: ***B 61 G 11/16 (2006.01)***

(45) Oversættelsen bekendtgjort den: **2020-03-30**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2020-01-01**

(86) Europæisk ansøgning nr.: **16155295.5**

(86) Europæisk indleveringsdag: **2016-02-11**

(87) Den europæiske ansøgnings publiceringsdag: **2016-08-24**

(30) Prioritet: **2015-02-17 FR 1551300**

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

(73) Patenthaver: **ALSTOM Transport Technologies, 48 rue Albert Dhalenne, 93400 Saint-Ouen, Frankrig**

(72) Opfinder: **SICOT, Patrick, 7, Faubourg de Niederbronn, 67110 Reichshoffen, Frankrig**
BERTRAND, Mathias, 21, Rue des Genêts, 67110 Niederbronn les Bains, Frankrig

(74) Fuldmægtig i Danmark: **Zacco Denmark A/S, Arne Jacobsens Allé 15, 2300 København S, Danmark**

(54) Benævnelse: **Indretning til stødabsorbering for en koblingsindretning af et jernbanekøretøj**

(56) Fremdragne publikationer:
EP-A1- 1 975 032
EP-A2- 2 277 762
WO-A1-2010/029188
WO-A1-2012/067526

The present invention relates to a device for absorbing energy in the event of impact for a coupling device of a railway vehicle.

A coupling device provides the connection between two carriages of a railway vehicle, while transmitting a pulling or pushing force from one carriage to the other. However, in the event of impact, the coupling must yield in order to allow the anti-climbing devices to engage and/or in order to absorb all or part of the collision energy.

To that end, there is already known in the prior art, especially from EP 1 975 032, a damping device with which such a coupling device is equipped, according to the preamble of claim 1.

There is also known a damping device comprising:
- a support member which is to be fixed to a structural part of a carriage of the railway vehicle,
- at least one guide bar which extends in a longitudinal direction between a first end fixed to the support member and a second end, and
- a bearing plate which is to cooperate with the coupler and which is displaceable along the guide bar, driven by the coupler as it is displaced under the effect of an impact.

The guide bar has a cross-section which is variable between a small cross-section and a large cross-section, and the bearing plate comprises a passage orifice having a diameter corresponding to the small cross-section of the bar. Thus, when the bearing plate is displaced along the bar under the effect of an impact, the contour of the passage orifice machines the bar circumferentially by passing over its zone of large cross-section, thus absorbing the energy of the impact while guiding the yielding of the coupler.

Thus, each bar provides both a function of guiding the bearing plate and a function of absorbing the energy of the impact. In order to function correctly, such a bar conventionally has a relatively high mass because it must withstand the machining forces and provide guiding.

The object of the invention is especially to reduce the mass of a damping device without impairing its effectiveness.

To that end, the invention especially provides a damping device according to claim 1.

In this novel system, absorption is no longer provided by machining the guide bars but by crushing deformable blocks (made of metallic or composite material) which are threaded onto the guide bars and inserted between the plates.

In order to crush the blocks without placing the guide bars under stress, it is necessary to ensure contact between the rear of the system and the bottom of the housing situated in the chassis at the end of the vehicle.

Given the manufacturing tolerances of the various groups involved in this assembly, there is a clearance between the rear of the system and the bottom of the housing which must be filled by separating the rear plate from the guide bars.

That is why, in the event of impact, the fusible fixing means break, so that the second bearing plate is no longer held by the guide bars but, for example, comes into contact with a structural bearing surface provided on the railway vehicle. Thus, the guide bars are not involved in absorbing the forces of the impact, the forces being absorbed by the structural bearing surface.

In other words, each guide bar performs only a guiding function.

Accordingly, it is not necessary for the guide bar to have a high mass, unlike a guide bar of the prior art. The mass of each guide bar can therefore be reduced, which therefore reduces the overall mass of the damping device according to the invention.

A damping device according to the invention may further have one or more of the following features, taken on their own or in any technically envisageable combinations.

- The damping device comprises two mutually parallel guide bars which each extend in the longitudinal direction between a first end fixed to the support member and a second end fixed in a fusible manner to the second bearing plate.
- The energy absorbing means comprise a passage for each guide bar, each guide bar being housed in the respective passage, maintaining the energy absorbing means transversely relative to the support member.
- The energy absorbing means comprise a honeycomb structure, or at least two honeycomb structures stacked in the longitudinal direction.
- The fusible fixing means comprise: a threaded portion formed at the second end of each guide bar and, for each guide bar, a fusible nut screwed onto the corresponding threaded portion.
- Each fusible nut is made of plastics material.
- Each fusible nut comprises at least two portions of lower strength.
- The second bearing plate comprises a network of ribs extending in the longitudinal direction.
- The fusible fixing means break when they are subjected to a longitudinal force of approximately from 50 to 100 kN.

The invention relates also to a railway vehicle carriage comprising a coupling device extending in a longitudinal direction, characterised in that it comprises a damping device as defined hereinbefore and a housing for the damping device, said housing comprising a back structural wall arranged facing the second bearing plate in the longitudinal direction.

In the event of impact, the coupling device is driven into said housing, damping the impact by deformation of the energy absorbing means.

The invention will be better understood from reading the following description, which is given solely by way of example and with reference to the accompanying figures, in which:
- Figure 1 is a perspective view of a railway vehicle carriage according to the invention, cut longitudinally;
- Figure 2 is a perspective view of a damping device according to an exemplary embodiment of the invention;
- Figure 3 is a view similar to Figure 2 showing part of the damping device of Figure 2;

- Figure 4 is a perspective view showing the rear of the damping device of Figure 2.

Figure 1 shows a railway vehicle carriage 10 according to an exemplary embodiment of the invention. The carriage 10 comprises a structural body 12 of conventional type, shown cut in a longitudinal direction X.

The structural body 12 is to carry a coupling device 14 (shown in Figure 2) and also a damping device 16 connected to the coupling device 14.

To that end, the structural body 12 comprises a housing 18, for example formed in a central portion of the structural body 12, for housing the damping device 16. The housing 18 extends in the longitudinal direction X between a mouth 20 and a back structural wall 22, closing the housing 18 laterally.

The structural body 12 additionally comprises buffers 26, 28 of conventional type which are arranged on either side of the housing 18 in a transverse direction Y perpendicular to the longitudinal direction X.

The coupling device 14 is of conventional type and therefore will not be described in detail. The coupling device 14 extends in the longitudinal direction X, in front of the structural body 12 when it is attached to the structural body 12.

The damping device 16 also extends in the longitudinal direction X as a continuation of the coupling device 14 when it is attached to the structural body 12.

The damping device 16 comprises a support member 30 which is to be fixed to a structural part of the carriage 10, and more particularly to the structural body 12, in the region of the mouth 20 of the housing 18. The support member 30 is firmly fixed to the structural part by conventional means (for example by screwing or welding), so that it remains fixed in the event of impact.

The damping device 16 additionally comprises at least one guide bar 32 (visible in Figure 3) extending in the longitudinal direction between a first end 32A fixed to the support member 30 and a second end 32B.

In the example described, the damping device 16 comprises two mutually parallel guide bars 32. These two guide bars 32 are spaced apart from one another by a transverse spacing which is greater than a transverse dimension of part of the coupling device 14 which is capable of being driven into the housing 18 in the event of impact. Thus, this part of the coupling device 14 is able to move between the guide bars 32 without being impeded by the guide bars 32.

In the example described, each guide bar 32 has a circular cross-section but, by way of variation, it may have any other form of cross-section, for example rectangular.

The damping device 16 additionally comprises a first bearing plate 34 which is to cooperate with the coupling device 14 and is displaceable along the guide bars 32. For example, the first bearing plate 34 comprises, for each guide bar 32, a passage opening for the guide bar 32, capable of sliding along the guide bar 32. The dimensions and the shape of the passage opening are thus complementary to those of the corresponding guide bar 32.

The coupling device 14 conventionally comprises an end plate (not shown) for fixing to the first bearing plate 34. The coupling device 14 thus moves with the first bearing plate 34. More precisely, the first bearing plate 34 is driven along the guide bars 32 by the coupling device 14 when the coupling device transmits the energy of an impact. Of course, the end plate has a transverse dimension which is smaller than the transverse spacing between the guide bars 32 in order to be able to move between them.

The damping device 16 comprises a second bearing plate 36 arranged at a distance from the first bearing plate 34 in the longitudinal direction X. The second end 32B of each guide bar 32 is fixed in a fusible manner to the second bearing plate 36 by fusible fixing means 38.

The fusible fixing means 38 are capable of breaking, thus freeing the second end 32B of each guide bar 32, when they receive the energy of an impact. For example, the fusible fixing means 38 break when they are subjected to a longitudinal force of approximately from 50 to 100 kN.

Moreover, it should be noted that the second bearing plate 36 is arranged facing the back structural wall 22 when the damping device 16 is housed in the housing 18. The back structural wall 22 is then spaced apart from the second bearing plate 36 by a longitudinal spacing of approximately fifteen millimetres owing to the construction tolerances of the various sub-groups involved in the assembly. Accordingly, when the fusible fixing means 38 break, the second bearing plate 36 comes into contact with the back structural wall 22.

As is shown in Figure 4, the second bearing plate 36 advantageously comprises ribs 40 extending in the longitudinal direction X, and therefore in the direction of the back structural wall 22, which ribs are to come into contact with the back structural wall 22 when the fusible fixing means 38 break.

According to a preferred embodiment, the fusible fixing means 38 comprise a threaded portion 42 formed at the second end 32B of each guide bar 32 and, for each guide bar 32, a fusible nut 44 screwed onto the corresponding threaded portion 42. The second bearing plate 36 then has a complementary passage opening for each guide bar 32, said threaded portion 42 extending beyond the passage opening, as is shown in Figure 4.

Each fusible nut 44 comprises at least one portion of lower strength in order to ensure that it breaks in the event of impact. Advantageously, each fusible nut 44 comprises at least two portions of lower strength, for example four. It is thus ensured that the fusible nut 44 breaks into multiple pieces, and that it therefore separates from the corresponding threaded portion 42.

Advantageously, each fusible nut 44 is made of plastics material in order to obtain a low breaking strength despite the large diameter of the nut, while ensuring that the rear part of the system is assembled under normal operating conditions.

Finally, the damping device 16 comprises means 46 for absorbing the energy of an impact by deformation, separate from the guide bars 32, which means extend in the longitudinal direction X between the first bearing plate 34 and the second bearing plate 36. The absorption means 46 are on the one hand in abutment against the first bearing plate 34 and on the other hand in abutment against the second bearing

plate 36, so that they deform, in particular by crushing, when the first bearing plate 34 is displaced along the guide bars 32 towards the second bearing plate 35.

The energy absorbing means 46 are at least partially hollow, so that they comprise a passage for each guide bar 32, each guide bar 32 being housed in the respective passage. The energy absorbing means 46 are therefore maintained transversely relative to the support member 30 by the guide bars 32. Because the guide bars 32 are arranged in the energy absorbing means 46, the energy absorbing means 46 are not shown in Figure 3 in order to allow the guide bars 32 to be seen. By contrast, they are visible in Figure 2 and Figure 4.

In the example described, the energy absorbing means 46 comprise a plurality of honeycomb structures 47 stacked in the longitudinal direction X. By way of variation, they may comprise only one honeycomb structure or any other type of conventional damping box.

The functioning of the damping device 16 will now be described.

As stated hereinbefore, the damping device 16 is housed in the housing 18, its support member 30 being fixed in the region of the mouth 20 and its second bearing plate 36 being arranged facing the back structural wall 22.

In the event of an impact transmitted by the coupling device 14, the coupling device applies a pushing force to the first bearing plate 34, which is moved as far as the second bearing plate 36 by the absorbing means 46.

It will be recalled here that the second bearing plate 36 is held by the guide bars 32, by the fusible fixing means 38. However, the strength of the fusible fixing means 38 is low, and more particularly is significantly lower than the resistance of the absorbing means 46 to deformation.

Thus, in the first instance, the fusible fixing means 38 break under the effect of this pushing force, releasing the fixing between the guide bars 32 and the second bearing plate 36.

The second bearing plate 36 is then free to move in the longitudinal direction X under the effect of the pushing force, so that it moves until it comes into contact with the back structural surface 22. The second bearing plate 36 in contact with the back structural surface 22 is then firmly immobilised in the longitudinal direction X.

The first bearing plate 34 is still subjected to the pushing force of the coupling device 14 and therefore moves in the longitudinal direction X, guided by the guide bars 32.

As it moves, the first bearing plate 34 compresses the absorbing means 46 against the immobilised second bearing plate 36, thus causing the absorbing means 46 to deform. The energy of the impact is then used to deform the absorbing means 46.

The coupling device 14 is thus driven into the housing 18, deforming the absorbing means 46, until all the energy of the impact has been absorbed or, more frequently, until the buffers 26, 28 come into contact with complementary buffers carried by another carriage which is connected thereto by the coupling device 14.

It is clear that, since the fusible fixing means 38 break at the very start of the impact, the guide bars 32 do not absorb any of the forces due to the impact. The guide bars 32 therefore have only a function of guiding the first bearing plate 34 in the longitudinal direction X, ensuring effective deformation of the absorbing means 46. The mass of the guide bars 32 can therefore be reduced, especially their transverse dimensions. For example, each guide bar can have a cross-section with a diameter of less than 65 mm.

Thus, the overall mass of the damping device 16 is reduced. More particularly, the overall mass may be approximately 200 kg for a damping device 16 according to the invention, whereas the overall mass of a damping device of the prior art is generally approximately 280 kg.

It will be noted that the invention is not limited to the embodiment described hereinbefore but may have different variants.

Patentkrav

1. Indretning (16) til stødabsorbering for en koblingsindretning (14) af en vogn (10) af et jernbanekøretøj, omfattende:
- en holdemiddel (30), der er beregnet til at fastgøres på en strukturdel (12) af vognen (10),
- mindst én føringsstang (32), der er strækker sig i en længderetning (X) mellem en første ende (32A), der er fastgjort til holdemidlet (30), og en anden ende (32B), og
- midler (46) til absorbering af energien fra et stød ved deformering, som er forskellig fra føringsstængerne (32),

kendetegnet ved, at den omfatter:
- en første anlægsflade (34), der er beregnet til at samvirke med koblingsindretningen (14) og kan forskydes langs den mindst én føringsstang (32),
- en anden anlægsplade (36), der er anbragt i afstand fra den første anlægsflade (34) i længderetningen (X), og
- smeltelige fastgørelsesmidler (38), som fastgør den anden ende (32B) af føringsstangen eller hver føringsstang (32) smelteligt med den anden anlægsplade (36),

og **ved, at** midlerne (46) til energiabsorbering strækker sig i længderetningen (X) mellem den første anlægsplade (34) og den anden anlægsplade (36).

2. Absorberingsindretning (16) ifølge krav 1, omfattende to indbyrdes parallelle føringsstænger (32), der hver især strækker sig i længderetningen (X) mellem en første ende (32A), der er fastgjort til holdemidlet (30), og en anden ende (32B), der er fastgjort smelteligt til den anden anlægsplade (36).

3. Absorberingsindretning (16) ifølge krav 1 eller 2, hvor energiabsorberingsmidlerne (46) omfatter en passage for hver føringsstang (32), hvor hver føringsstang (32) hver især er optaget i en passage, mens energiabsorberingsmidlerne (46) fastholdes i tværretningen i forhold til holdemidlet (30).

4. Absorberingsindretning (16) ifølge et hvilket som helst af kravene 1 til 3, hvor energiabsorberingsmidlerne (46) omfatter en bikagelignende struktur, eller mindst to bikagelignende strukturer (47), der er stablet i længderetningen (X).

5. Absorberingsindretning (16) ifølge et hvilket som helst af de foregående krav, hvor de smeltelige fastgørelsesmidler (38) omfatter:
- en gevindskåret del (42), som er tilvejebragt i den anden ende (32B) af hver føringsstang (32),
- til hver føringsstang (32), en smeltelig møtrik (44), der er skruet på den tilsvarende gevindskårede del (42).

6. Absorberingsindretning (16) ifølge krav 5, hvor hver smeltelige møtrik (44) er fremstillet af plastmateriale.

7. Absorberingsindretning (16) ifølge krav 5 eller 6, hvor hver smeltelige møtrik (44) omfatter mindst to dele med mindre modstandskraft .

8. Absorberingsindretning (16) ifølge et hvilket som helst af de foregående krav, hvor den anden anlægsplade (36) omfatter et netværk af ribber (40), der strækker sig i længderetningen.

9. Absorberingsindretning (16) ifølge et hvilket som helst af de foregående krav, hvor de smeltelige fastgørelsesmidler (38) brydes, når de udsættes for en langsgående kraft fra 50 til 100 kN.

10. Vogn (10) af et jernbanekøretøj, omfattende en koblingsindretning (14), der strækker sig i en længderetning (X), **kendetegnet ved, at** den omfatter en absorberingsindretning (16) ifølge et hvilket som helst af de foregående krav, og et hus (18) til absorberingsindretningen (16), hvor huset omfatter en strukturbundvæg (22), der er anbragt over for den anden anlægsplade (36) i længderetningen (X).

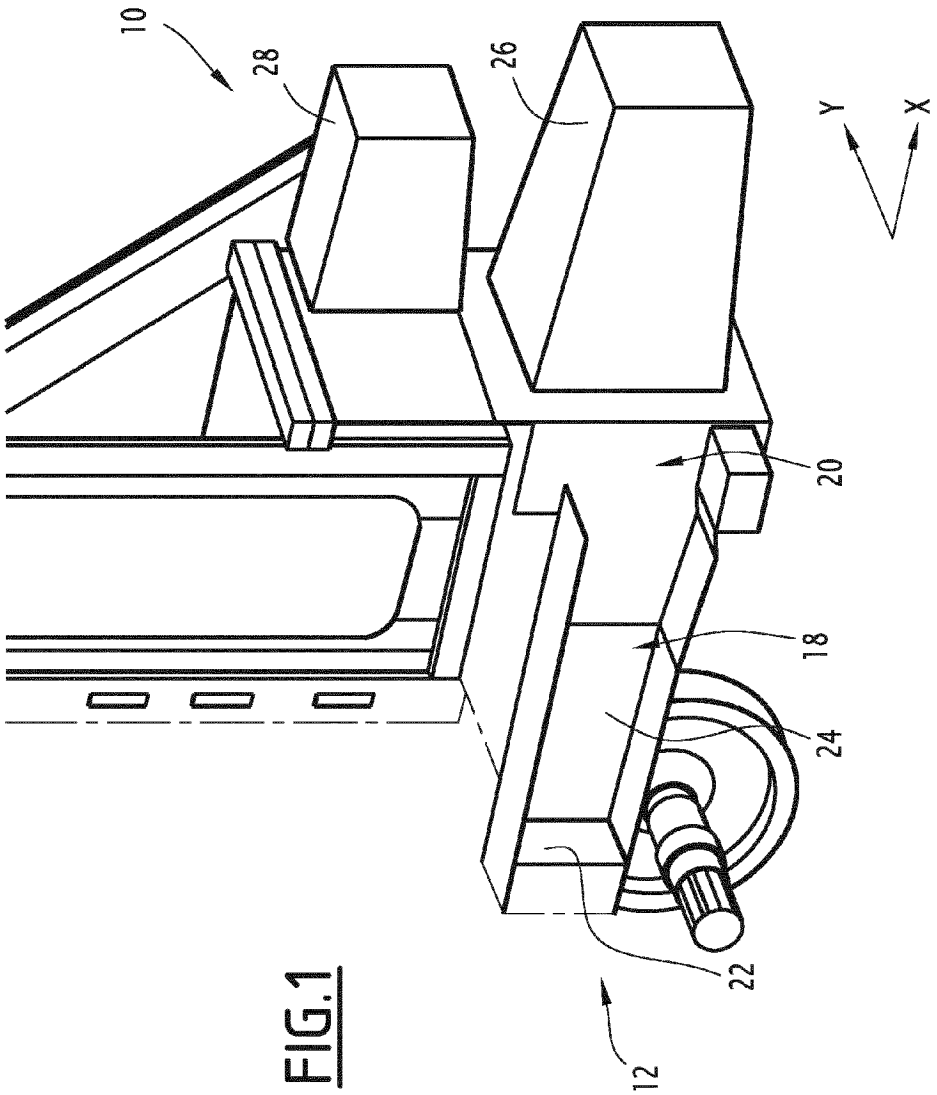

FIG.1

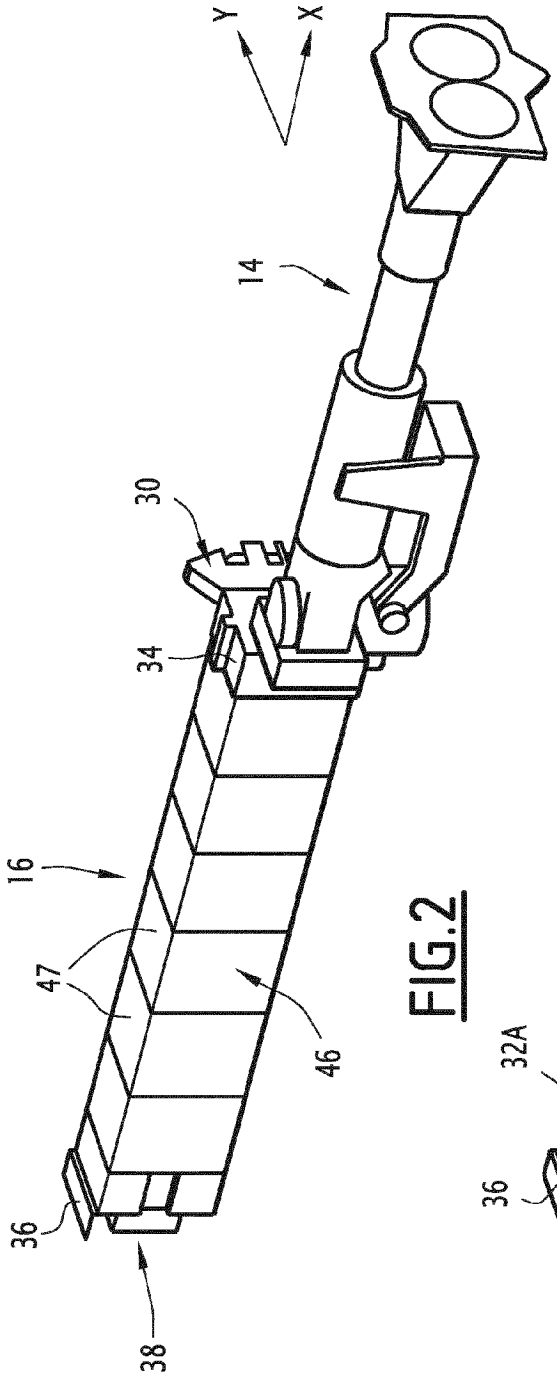

FIG.2

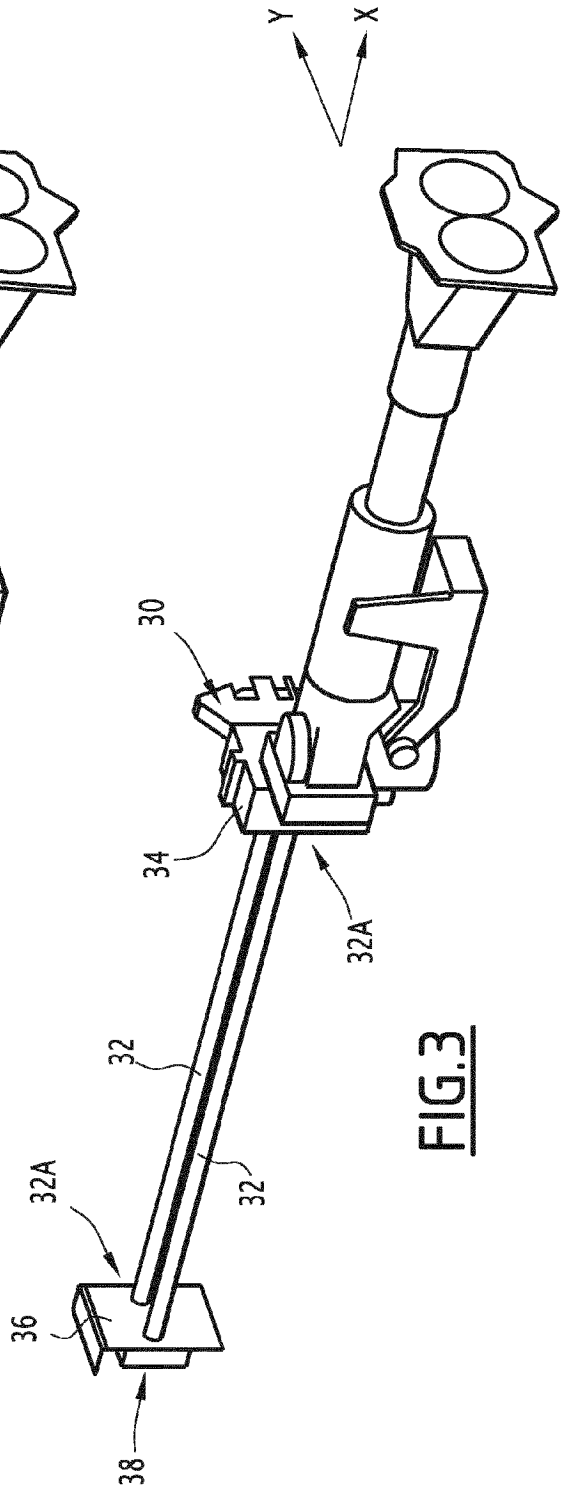

FIG.3

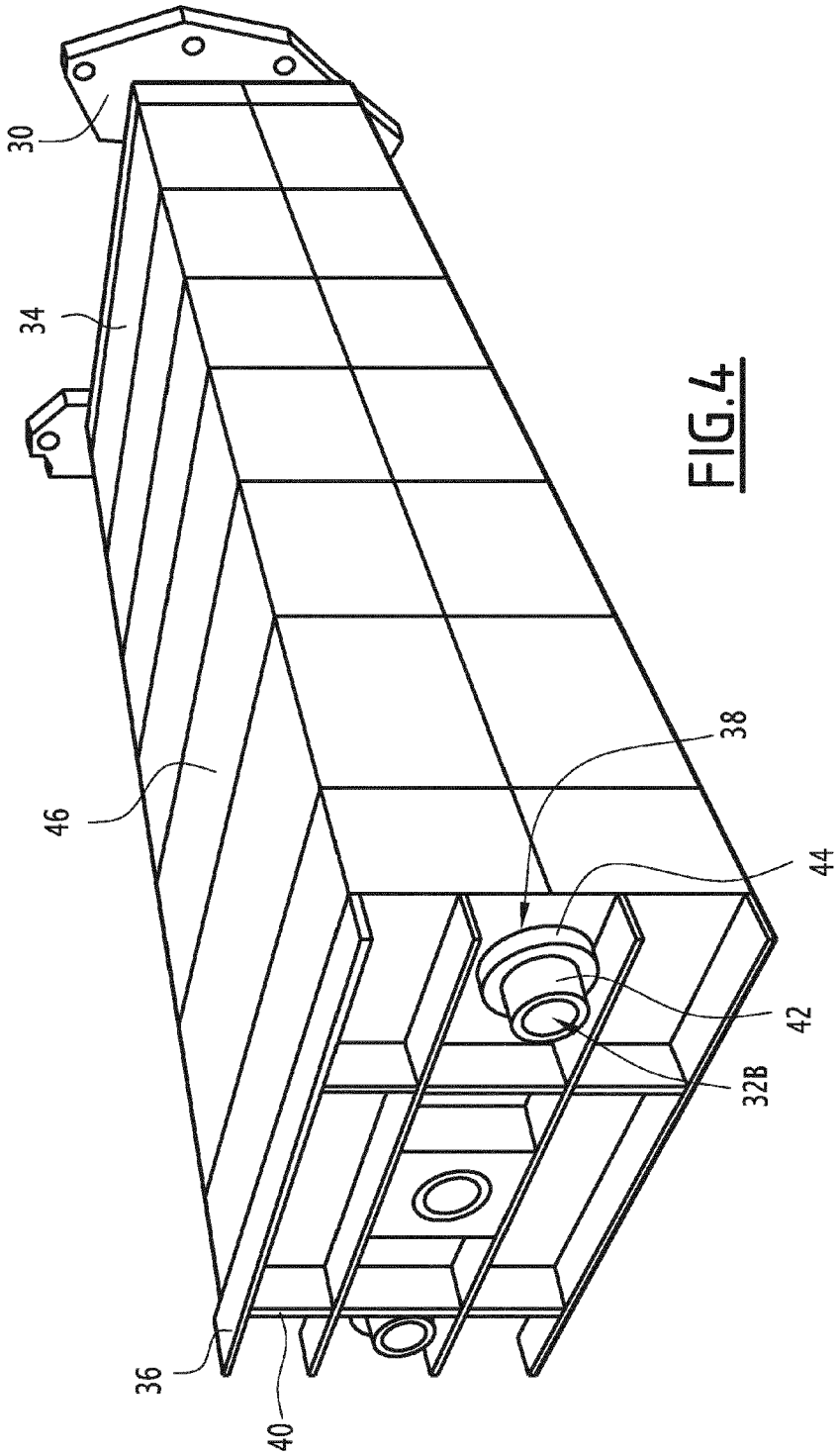

FIG.4