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ALSTOM

**Assembly comprising a first chassis and a second
chassis tilting laterally with respect to the first
chassis, and corresponding railway vehicle**

ABSTRACT

The invention relates to an assembly (1) for a railway vehicle, of the type comprising a first chassis (8) and a second chassis (9) which is connected to the stationary chassis (8) to tilt laterally with respect thereto on each side of a position of rest, the assembly (1) further comprising means (10) for moving the second chassis (9) laterally. The movement means (10) comprise an arm (28) for driving the second chassis (9) laterally, which arm (28) is mounted so that it can pivot about a longitudinal axis (X-X).

Application, for example, to a power pick-up assembly for a tilting railway vehicle.

Fig. 1.

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**COMPLETE SPECIFICATION
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Invention Title:

ASSEMBLY COMPRISING A FIRST CHASSIS AND A SECOND CHASSIS TILTING Laterally
WITH RESPECT TO THE FIRST CHASSIS, AND CORRESPONDING RAILWAY VEHICLE

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The following statement is a full description of this invention, including the best method of performing it known to applicant(s):

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The subject of the present invention is an assembly for a railway vehicle.

The invention applies, for example, to a power pick-up assembly for a tilting railway vehicle.

5 Such a railway vehicle is designed so that its body shall adopt a lateral inclination with respect to the axis of the axles of its bogies in the curved parts of railway lines.

10 In the case of a power pick-up assembly, the first chassis is a stationary chassis intended for mounting the assembly on the roof of a railway vehicle, and the second chassis is a mobile chassis which carries a pantograph belonging to the power pick-up assembly.

15 If such an assembly is mounted on top of the railway vehicle for picking up power from an overhead power line, it then becomes necessary for the pantograph to be inclined laterally with respect to the body in the opposite direction to the direction in which the body is inclined with respect to its axles, so as to limit the lateral movement of the collector bow of the pantograph with respect to the contact line of the overhead power lines.

20 This is because if there were no such inclination of the pantograph in the opposite direction, known as tilt compensation inclination, the relative movement of the collector bow with respect to the contact line could be great enough for the line to be in contact only with the insulated parts of the collector bow or even spaced laterally from it, and this could cause damage to the overhead line and to the pantograph, particularly as the
25 body returns to its position of rest.

30 Document EP-A-785,100 describes a power pick-up assembly of the aforementioned type in which the mobile pantograph support chassis is connected by four link rods to the stationary chassis. At rest, that is to say when
35 there is no tilt compensation, the points of articulation of the link rods transversely form a downwards-converging trapezium. The lateral movement of the mobile chassis causes the pantograph to be inclined laterally with respect to the body.

The lateral movement of the mobile chassis is brought about by means of one or more rams which thrust the mobile chassis laterally and which is or are arranged on one side or both sides of the pantograph support. A control system
5 steers the ram(s) to move the mobile chassis and provide the pantograph with tilt compensation.

To ensure satisfactory movement of the mobile chassis while at the same time limiting the unwanted movements in translation and rotation, it is appropriate to provide
10 guides against which the mobile chassis slides, and to fit a central lateral ram on each side of the mobile chassis.

The electrical isolation of the pantograph from the roof of a railway vehicle is provided by electrical insulators arranged between the pantograph and the mobile
15 chassis.

Correct operation of the power pick-up assembly therefore entails a complex bulky structure which is subject to dissipation of mechanical energy by rubbing at the guides which thus constitute wearing parts.

The substantial bulk of a power pick-up assembly of this kind is a particular hindrance in complying with size requirements imposed on railway vehicles without limiting the headroom available for the passengers within the vehicle.
20

The above discussion of background art is included to explain the context of the present invention. It is not to be taken as an admission that any of the material referred to was published, known or part of the common general knowledge in Australia as at the priority date of any of
25 the claims of this specification.

It would be desirable to provide an assembly of the aforementioned type which is less bulky.

According to a first aspect, the present invention provides an assembly for a railway vehicle, including a
35 first chassis and a second chassis which is connected to the first chassis to tilt laterally with respect thereto on each side of a position of rest, the assembly further including means for moving the second chassis laterally, wherein the second chassis is connected to the first

chassis by at least two laterally-spaced pivoting links and wherein the movement means include an arm for driving the second chassis laterally which is connected to this second chassis at a point located laterally roughly mid-way between the two pivoting links when the second chassis is in the position of rest, the arm being mounted so that it can pivot about a longitudinal axis.

According to particular embodiments, the assembly may include one or more of the following preferred features, taken in isolation or in any technically feasible combination:

- the arm is connected to the second chassis at a point which roughly describes an arc of a circle centred on the said longitudinal axis when the second chassis tilts with respect to the first chassis in the vicinity of its position of rest;

- the second chassis is connected to the first chassis by at least two laterally-spaced pivoting links;

- the arm for driving the second chassis laterally is connected to this second chassis at a point located laterally roughly mid-way between the two pivoting links when the second chassis is in the position of rest;

- each pivoting link includes a tilting rigid support articulated, on the one hand, to the first chassis at two longitudinally-spaced points and, on the other hand, to the second chassis at two longitudinally-spaced points;

- each tilting support includes a yoke articulated by its branches to the first chassis, and two clevis mounts which extend the base of the yoke and which are articulated to the second chassis;

- each tilting support has a transverse profile with its concave aspect facing towards the inside of the assembly;

- the clevis mounts of each tilting support are roughly orthogonal to the branches of the corresponding yoke;

- the points by which the tilting supports are articulated to the first and second chassis form, transversely, when the second chassis is in the position of

rest, a trapezium which converges, in the direction from the said longitudinal axis towards a point on the second chassis to which the arm is connected;

- the arm is connected to the second chassis as a pivoting and sliding link;

- the assembly is a power pick-up assembly for a railway vehicle, including a pantograph and a pantograph support, the pantograph support including the first chassis for mounting the assembly on the roof of a railway vehicle, and the second chassis which carries the pantograph;

- the arm is connected to the second chassis at a point located below the said longitudinal axis when the power pick-up assembly is mounted on the roof of a railway vehicle;

- the first chassis includes means for electrically isolating the pantograph from the roof of a railway vehicle on which the assembly is intended to be mounted;

- the first chassis includes electric insulators which form feet for supporting the first chassis on the roof of a railway vehicle;

- the first chassis includes four electric insulators forming support feet arranged in a square or rectangular overall configuration;

- the means for moving the second chassis includes some of the means of electric isolation;

- the means for moving the second chassis includes a rotary motor for actuating the arm for driving the second chassis, and the output shaft of the rotary motor is oriented longitudinally;

- the rotary motor is connected to the arm by an electric insulator.

According to another aspect, the present invention provides a railway vehicle including an assembly as defined hereinabove.

The invention will be better understood upon reading the description which will follow, which is given merely by way of example and made with reference to the appended drawings, in which:

5 - Figure 1 is a diagrammatic part view in perspective illustrating the roof of a railway vehicle according to the invention,

 - Figure 2 is a diagrammatic view in exploded perspective of the pantograph support and of the means
10 for moving the power pick-up assembly of the vehicle of Figure 1,

 - Figure 3 is an enlarged diagrammatic view in longitudinal section illustrating the link between the movement means and the mobile chassis of Figures 1 and
15 2,

 - Figures 4 and 5 are diagrammatic transverse views illustrating the railway vehicle of Figure 1 in a position of rest and in a tilted position, respectively, and

20 - Figure 6 is a diagrammatic partial transverse view of another assembly according to the invention, applied to a bogie of a tilting railway vehicle.

 Figure 1 illustrates a power pick-up assembly 1 mounted on top of the roof 2 of a tilting railway vehicle 3. Only part of the roof 2 is depicted
25 diagrammatically in chain line in Figure 1.

 This power pick-up assembly 1 essentially comprises:

 - a pantograph 4 itself comprising an articulated
30 arm 5 equipped with a collector bow 6 at an upper end,

 - a pantograph support 7 itself comprising a stationary first chassis 8 and a mobile second chassis 9, and

 - means 10 for moving the mobile chassis 9.
35 For reasons of clarity, the depiction of the support 7 has been simplified in Figure 1, but Figure 2 illustrates its structure more fully.

 The stationary chassis 8 comprises a frame 11 of roughly square or rectangular shape, and four

electric insulators 12 one arranged at each corner of the frame 11, under the latter. The stationary chassis 8 is mounted on the roof 2 via the electric insulators 12 which form feet supporting the chassis 8 on the roof 2. The insulators 12 keep the stationary 8 frame 11 spaced away from the roof 2.

The mobile chassis 9 is a frame of smaller dimensions than the frame 11. The mobile chassis 9 is arranged inside the stationary chassis 8 and is connected thereto by two tilting rigid supports 14 arranged one on each side of the mobile chassis 9.

Each support 14 comprises a U-shaped part 15 or yoke, the two branches 16 of which are articulated at points 17 to the front side 18 and to the rear side 19 of the frame 11, and two lugs or clevis mounts 20, extending the base 21 of the yoke 15 downwards orthogonally to the branches 16, and which are articulated at points 22 to a lateral side of the mobile chassis 9.

The tilting supports 14 therefore, relative to the longitudinal direction L of the vehicle 3, have a cranked transverse profile, with the concave aspect facing towards the inside of the pantograph support 7.

The points 17 and 22 are points of articulation about axes which are parallel to the longitudinal direction L.

The points 17 of articulation of the branches 16 and, respectively, the points 22 of articulation of the lugs 20 of one same tilting support 14 are longitudinally aligned and spaced apart, that is to say are aligned and spaced apart in the longitudinal direction L of the vehicle 3.

Figure 4 diagrammatically illustrates the body of the vehicle 3 in the position of rest, that is to say in the absence of tilting, and therefore with its roof 2 parallel to the axis of the axles of its bogies and to the plane of a railway line on which the vehicle 3 is standing. In this figure, the plane of the railway line is assumed to be horizontal and only the body of

the vehicle 3 and the power pick-up assembly 1 are depicted. The points 17 and 22 of articulation of the tilting supports 14 to the stationary chassis 8 and to the mobile chassis 9 therefore transversely form an isosceles trapezium converging downwards, that is to say converging towards the roof 2 of the railway vehicle.

It will be noted that in this Figure 4, the tilting supports 14 have been depicted, for reasons of simplification, as having a straight transverse profile.

The distance laterally separating the points of articulation 17 of the two tilting supports 14 is about 870 mm. The distance laterally separating the points of articulation 22 of the two tilting supports 14 is about 760 mm. The distance transversely separating the points of articulation 17 and 22 of one same tilting support 14 is about 280 mm. The points 17 of articulation of the tilting supports 14 to the stationary chassis 8 are located 540 mm above the roof 2.

By virtue of the tilting supports 14 which form two laterally-spaced pivoting links, the mobile chassis 9 can tilt laterally with respect to the stationary chassis 8 on each side of its position of rest depicted in Figure 4, the quadrilateral formed transversely by the points of articulation 17 and 22 thus deforming.

Because of the rigidity of the supports 14 and the longitudinal spacing of the points of articulation 17 and 22, the mobile chassis 9 is guided satisfactorily in its tilting movement, with limited unwanted movements in rotation and translation.

As can be seen in Figures 1 and 2, the means 10 of moving the mobile chassis 9 are arranged at the front (to the left in Figures 1 and 2) of the pantograph support 7 and comprise an electric motor 26, reduction gearing 27 and an arm 28.

The electric motor 26 is fixed by a support 29 to the roof 2 of the railway vehicle 3. Its output shaft, not depicted, is parallel to the longitudinal

direction L and orientated towards the rear. This output shaft is connected to the reduction gearing 27 via an electric insulator 30.

5 The reduction gearing 27 is flange-mounted on the front side 18 of the frame 11 of the stationary chassis 8. Its output shaft 31 (Figure 3) is parallel to the longitudinal direction L and extends from the front side 18 of the stationary chassis 8 rearwards slightly.

10 The upper end 33 of the arm 28 is fixed to this output shaft 31 so that the arm 28 can pivot on the action of the motor 26 laterally about an axis X-X parallel to the longitudinal direction L.

15 The lower end 34 of the arm 28 has an oblong groove 35 extending in the lengthwise direction of the arm 28, on the rear side thereof. This slightly oblong groove 35 takes a ball 36 fixed on a stub 37 which projects forwards from the front side 39 of the mobile chassis 9. The ball 36 and the oblong groove 35 form, 20 between the driving arm 28 and the mobile chassis 9, a link which allows pivoting and radial sliding with respect to the axis X-X.

As illustrated diagrammatically by Figure 4, the ball 36, which corresponds to the point of 25 articulation of the arm 28 to the mobile chassis 9, is situated at the centre of the short base of the trapezium formed by the points of articulation 17 and 22. Thus, the point of articulation 36 is located laterally mid-way between the points 22 about which the 30 tilting supports 14 are articulated to the mobile chassis 9.

Likewise, the axis X-X about which the arm 28 can pivot is located laterally mid-way between the points 17 about which the tilting supports 14 are 35 articulated to the stationary chassis 8. This axis X-X is located slightly below the level of these points of articulation 17. However, the axis X-X has, for reasons of clarity, been depicted on the long base of the

trapezium formed transversely by the points of articulation 17 and 22.

The lower end of the arm 5 of the pantograph 4 is connected to the mobile chassis 9 in such a way as to secure the arm 5 and the mobile chassis 9 laterally.

The tilting supports 14 are therefore arranged laterally on each side of the pantograph 4.

In the conventional way, the arm 5 is deformable between a deployed power pick-up position and a folded space-minimizing position, to allow the collector bow 6 a movement of vertical translation above the roof 2.

In its deployed position, illustrated in dotted line in Figure 4, a central region 43 of the collector bow 6 of the pantograph 4 is pressing against a contact line 44 of a set of overhead power lines over the top of the railway vehicle 3.

In the folded position (Figure 1), the intermediate articulation 45 of the arm 5, connecting its lower portion 46 and its upper portion 47, is located to the rear of the pantograph support 7.

When the railway vehicle 3 is running along a curved part of railway line, its body, and therefore the roof 2 adopts a lateral inclination α towards the centre of curvature of the track, for example towards the left as illustrated in Figure 5.

The motor 26 is therefore commanded by a control unit, not depicted, to cause the arm 28 to pivot laterally in the opposite direction, that is to say towards the right in Figure 5. The mobile chassis 9 is therefore moved laterally with respect to the stationary chassis 8 under the action of the arm 28 so that the arm 5 of the pantograph 4 is kept roughly vertical or orthogonal to the railway line.

Thus, the collector bow 6 is kept roughly horizontal or parallel to the plane of the railway line and the contact line 44 of the overhead power line is kept in contact with the central region 43 of the collector bow 6.

It will be observed that when the mobile chassis 9 moves laterally in the vicinity of its position of rest, by deformation of the quadrilateral formed transversely by the points of articulation 17 and 22, the point of articulation 36 moves practically in an arc of a circle 49 (Figure 5) centred on the axis X-X.

Thus, the arm 28 for driving the mobile chassis 9 makes it possible for the chassis to be moved satisfactorily to provide the pantograph 4 with tilt compensation.

In general, the stationary chassis 8 and the mobile chassis 9 and the links between these will be designed so that the point of articulation 36 roughly describes an arc of a circle when the mobile chassis 9 tilts with respect to the stationary chassis 8 so as to provide tilt compensation for angles of tilting smaller than 10°.

In practice, the sliding link between the lower end 34 of the arm 28 and the mobile chassis 9 makes it possible to absorb the small radial misalignments of the ball 36 with respect to the arc of a circle 49.

By virtue of the structure of the means 10 for moving the mobile chassis 9, the bulk, particularly the lateral bulk, of the power pick-up assembly 1 is relatively small. Furthermore, this assembly 1 makes it possible to provide the pantograph 4 with satisfactory tilt compensation. What is more, the link between the drive means 10 and the mobile chassis 9 is relatively simple and therefore reliable.

It will be noted that this principle may be used more generally for an assembly comprising a first chassis and a second chassis which tilts with respect to the first chassis.

As illustrated by Figure 6, this principle can thus be applied to a bogie of a tilting railway vehicle 3. The first chassis 8 therefore comprises at least one bolster resting via primary suspensions 53 on an axle 54 of the bogie, and the second chassis 9 comprises at

least one transom supporting the body of the vehicle 3 via secondary suspensions 45. In this case, the second chassis 9 carries the body of the railway vehicle so as to cause it to tilt.

5 The arm 28 here too makes it possible to limit the lateral bulk of the means 10 for moving the second chassis 9 laterally.

10 It will be noted that in Figure 6, the trapezium formed by the points of articulation 17 and 22 faces upwards, that is to say in the opposite direction to the direction from the axis X-X towards the point 36.

15 Returning to Figures 1 to 5, the fact that the electric insulators 12 form part of the stationary chassis 8 makes it possible to reduce the total vertical bulk of the power pick-up assembly 1 still further by comparison with cases in which these insulators are arranged between the pantograph 4 and the mobile chassis 9.

20 This characteristic also makes it possible to reduce the vertical size and the mass of those elements of the assembly 1 which tilt with respect to the stationary chassis 8.

25 The position of the insulators 12 therefore contributes, separately, to reducing the overall size of the power pick-up assembly 1.

30 It will also be noted that the mobile chassis 9 is kept a sufficient distance off the roof 2 to guarantee good electrical insulation between the chassis 9 and the roof 2.

35 It will also be noted that the transverse profile of the tilting supports 14, with their concave aspect facing towards the inside of the pantograph support 7, makes it possible to obtain a wide angular excursion of the pantograph supports 14 in a small volume. This characteristic makes it possible to reduce the bulk of the power pick-up assembly 1 still further.

Incidentally, the tilting rigid supports 14 provide the mobile chassis 9 with satisfactory lateral

guidance and limited rubbing. The presence of the tilting supports 14 means that the two lateral rams and guides hitherto needed for satisfactorily driving the mobile chassis 9 can therefore be dispensed with.

5 The tilting rigid supports 14 therefore also but separately play a part in, on the one hand, limiting the size of the power pick-up assembly 1 and, on the other hand, obtaining effective tilt compensation for the pantograph.

10 Furthermore, the structure of the support 7 for supporting the pantograph 4 allows the use of a pantograph 4 of conventional structure.

15 Finally, the arm 28 can easily, according to an alternative form which has not been depicted, be fitted with a finger for indexing the mobile chassis 9 in the position of rest. Such a finger allows the mobile chassis 9 to be held accurately in a position of rest without supplying energy, so as to allow the train to run in the event of a breakdown with the movement means
20 10. This alternative form may be applied in general to an assembly comprising a first chassis and a second chassis which can tilt with respect to the first chassis, for example to the assembly described with reference to Figure 6.

25 Finally, it is to be understood that various alterations, modifications and/or additions may be introduced into the assembly and railway vehicle previously described without departing from the spirit or ambit of the invention.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. An assembly for a railway vehicle, including a first chassis and a second chassis which is connected to the first chassis to tilt laterally with respect thereto on each side of a position of rest, the assembly further including means for moving the second chassis laterally, wherein the second chassis is connected to the first chassis by at least two laterally-spaced pivoting links and wherein the movement means include an arm for driving the second chassis laterally which is connected to this second chassis at a point located laterally roughly mid-way between the two pivoting links when the second chassis is in the position of rest, the arm being mounted so that it can pivot about a longitudinal axis.
2. An assembly according to claim 1, wherein the driving arm is connected to the second chassis at a point which roughly describes an arc of a circle centred on the said longitudinal axis when the second chassis tilts with respect to the first chassis in the vicinity of its position of rest.
3. An assembly according to claim 1 or 2, wherein each pivoting link includes a tilting rigid support articulated, on the one hand, to the first chassis at two longitudinally-spaced points and, on the other hand, to the second chassis at two longitudinally-spaced points.
4. An assembly according to claim 3, wherein each tilting support includes a yoke articulated by its branches to the first chassis, and two clevis mounts which extend the base of the yoke and which are articulated to the second chassis.
5. An assembly according to claim 3 or 4, wherein each tilting support has a transverse profile with its concave aspect facing towards the inside of the assembly.

6. An assembly according to claim 4 or claim 5 when dependent on claim 4, wherein the clevis mounts of each tilting support are roughly orthogonal to the branches of the corresponding yoke.

5

7. An assembly according to any one of claims 3 to 6, wherein the points by which the tilting supports are articulated to the first and second chassis form, transversely, when the second chassis is in the position of rest, a trapezium which converges, in the direction from the said longitudinal axis towards a point on the second chassis to which the driving arm is connected.

10

8. An assembly according to any one of claims 1 to 7, wherein the driving arm is connected to the second chassis by a pivoting and sliding link.

15

9. An assembly according to any one of claims 1 to 8, wherein the assembly is a power pick-up assembly for a railway vehicle, including a pantograph and a pantograph support, the pantograph support including the first chassis for mounting the assembly on the roof of a railway vehicle, and the second chassis which carries the pantograph.

20

10. An assembly according to claim 9, wherein the arm is connected to the second chassis at a point located below the said longitudinal axis when the power pick-up assembly is mounted on the roof of a railway vehicle.

25

11. An assembly according to claim 9 or 10, wherein the first chassis includes means for electrically isolating the pantograph from the roof of a railway vehicle on which the assembly is intended to be mounted.

30

12. An assembly according to claim 11, wherein the first chassis includes electric insulators which form feet for supporting the first chassis on the roof of a railway vehicle.

35

13. An assembly according to claim 12, wherein the first chassis includes four electric insulators forming support feet arranged in a square or rectangular overall configuration.

5

14. An assembly according to any one of claims 9 to 13, wherein the means for moving the second chassis include some of the means of electric isolation.

10 15. An assembly according to any one of the proceeding claims, wherein the means for moving the second chassis include a rotary motor for actuating the arm for driving the second chassis, and wherein the output shaft of the rotary motor is oriented longitudinally.

15

16. An assembly according to claim 15 when dependent on claim 14, wherein the rotary motor is connected to the driving arm by an electric insulator.

20 17. A railway vehicle, including an assembly according to any one of claims 1 to 16.

25 18. An assembly for a railway vehicle substantially as herein described with reference to the accompanying drawings.

19. A railway vehicle substantially as herein described with reference to the accompanying drawings.

30 Dated: 06 December 2002
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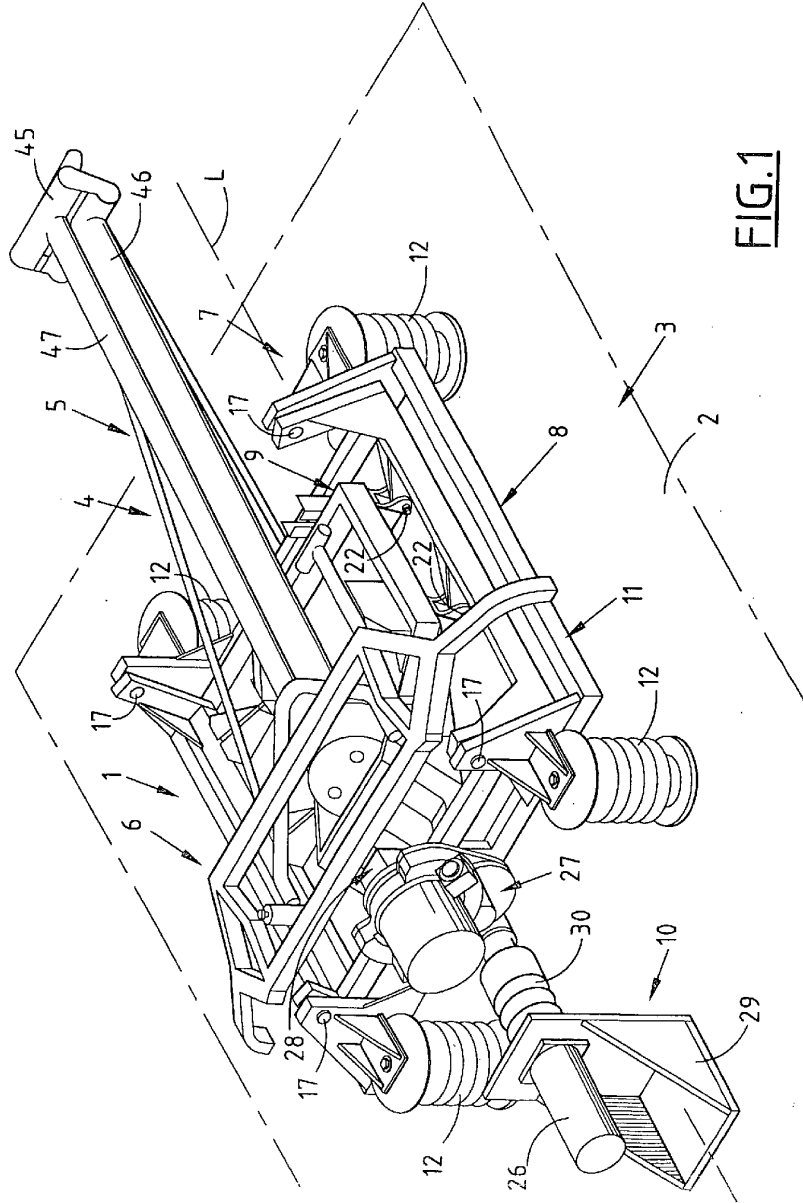
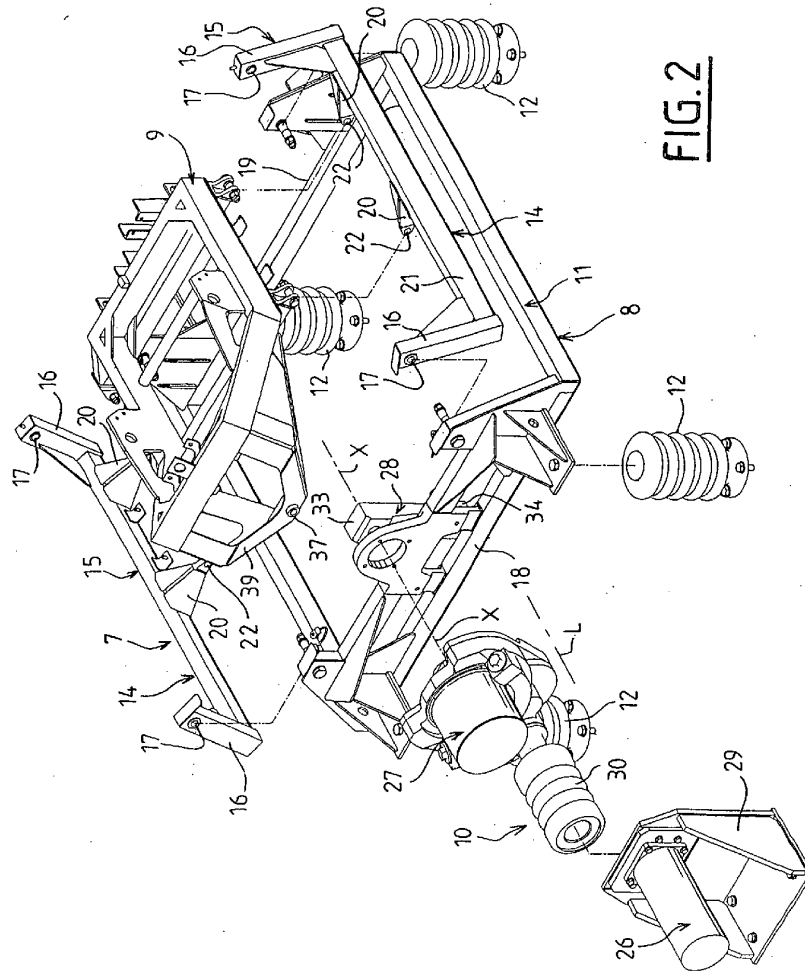


FIG. 1

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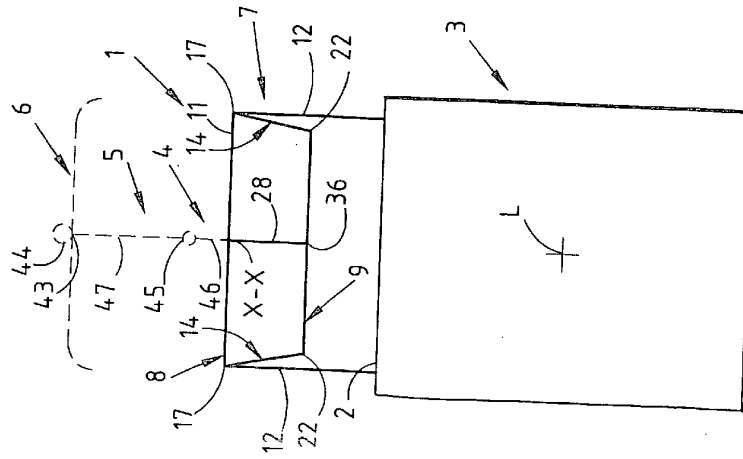


FIG. 4

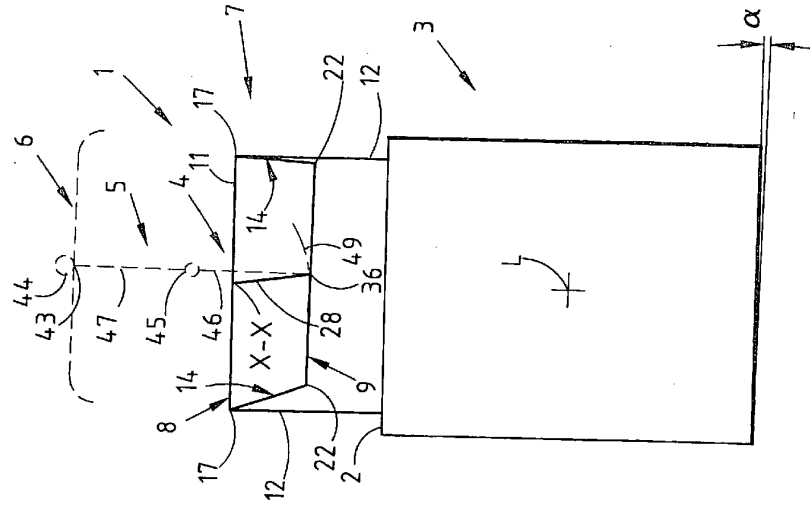


FIG. 5

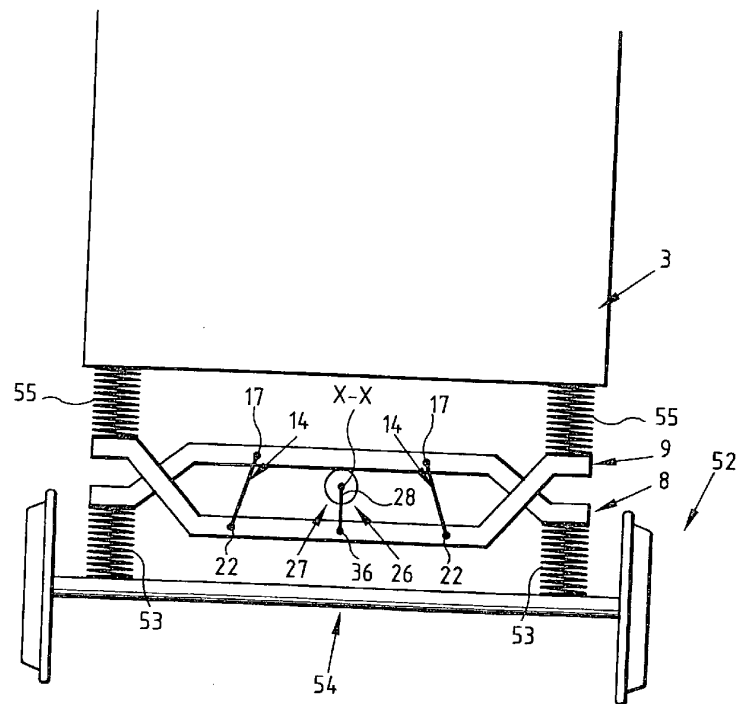


FIG. 6