

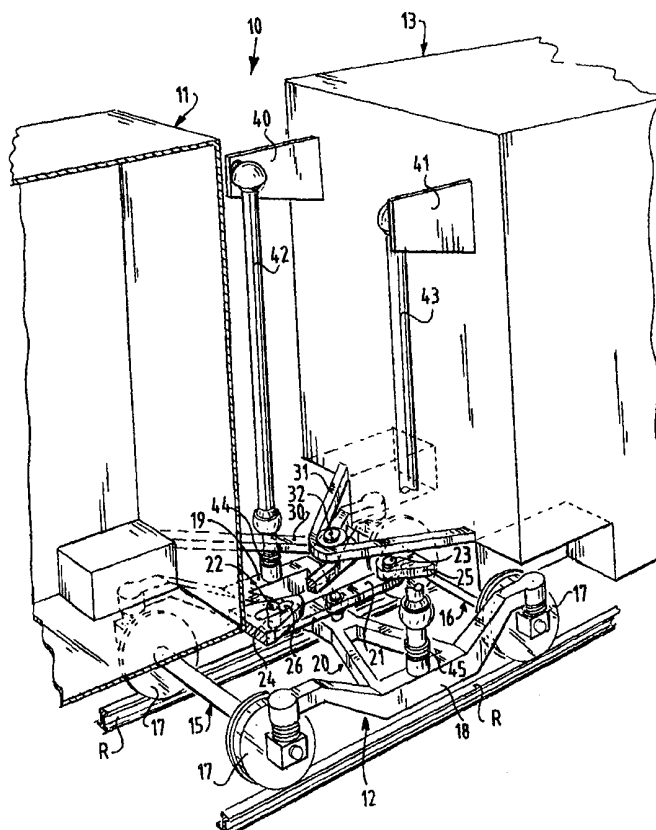
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification <sup>7</sup> : <b>B61F 3/12</b></p>	<p><b>A1</b></p>	<p>(11) International Publication Number: <b>WO 00/03905</b></p> <p>(43) International Publication Date: 27 January 2000 (27.01.00)</p>
<p>(21) International Application Number: PCT/EP99/05330</p> <p>(22) International Filing Date: 16 July 1999 (16.07.99)</p> <p>(30) Priority Data: 1009685 17 July 1998 (17.07.98) NL</p> <p>(71) Applicant (for all designated States except US): STORK RMO B.V. [NL/NL]; Oostenburgervoorstraat 181, NL-1081 MP Amsterdam (NL).</p> <p>(72) Inventors; and (75) Inventors/Applicants (for US only): KEIZER, Cornelis, Pieter [NL/NL]; Prins Bernhardlaan 2, NL-3135 JB Vlaardingen (NL). VAN DER STEEN, André [NL/NL]; Kanaalstraat 100 bis, NL-3531 CM Utrecht (NL).</p> <p>(74) Agent: LAND, Addick, Adrianus, Gosling; Arnold &amp; Siedsma, Sweelinckplein 1, NL-2517 GK The Hague (NL).</p>	<p>(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p><b>Published</b> <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>	

(54) Title: RAIL VEHICLE AND RUNNING MECHANISM THEREFOR

(57) Abstract

The present invention provides a rail vehicle (10), comprising: two or more carriage parts (11, 13); a running mechanism (12) having a frame and two or more wheel axles (15, 16); bearing means arranged substantially longitudinally at a distance from the heart of the frame for supporting the running means on the frame, wherein at least one of the carriage parts (11, 13) is substantially movable in a longitudinal direction with respect to the bearing means; and coupling means arranged on the carriage parts (11, 13) for rotatably coupling the carriage parts to one another.



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**RAIL VEHICLE AND RUNNING MECHANISM THEREFOR**

In many city areas the tram is still one of the most efficient means of public transport, for example due to the fact that in such city areas it is practically almost impossible to construct an underground rail  
5 system.

Since tram carriages have insufficient capacity during the rush hour in many cities, there exists the need for longer carriages for trams. However, this entails the problem that the so called profile of  
10 available free area on both sides of the rails is often limited. With longer carriages, these carriages sway out further than is desirable in the bends, especially in S-shaped bends, which makes an extension of such carriage, taken into consideration the available free area,  
15 practically impossible.

A train is known from the French patent publication FR-A-2 126 781 which is provided with a construction for limiting swaying out in connection with the available free area. Here, the carriages are  
20 supported on a beam which is displaceable against a spring mechanism in the transverse direction with respect to the chassis.

The present invention aims to provide a rail vehicle, especially a tram, wherein the available free  
25 area is utilized as optimally as possible and wherein a light construction requiring little maintenance is utilized.

The present invention aims to provide a rail vehicle, such as a tram or a train, wherein the available  
30 free area is utilized as optimally as possible.

The present invention provides a rail vehicle comprising:

- two or more carriage parts;

- a running mechanism having a frame and two or more wheel axles;

- bearing means arranged substantially longitudinally at a distance from the heart of the frame for supporting the running means on the frame, wherein at least one of the carriage parts is substantially movable in a longitudinal direction with respect to the bearing means; and

- coupling means arranged on the carriage parts for rotatably coupling the carriage parts to one another.

Since the carriage parts are rotatably coupled to one another and at least one of the carriage parts is somewhat shiftable with respect to the frame of the bogie, the point of rotation between the carriages is forced somewhat outwards during passage through a bend, whereby the available free area for a determined length of carriages can become smaller, or whereby the carriages can be extended to the same order of the available free area.

A first preferred embodiment comprises a longitudinal beam rotatably arranged near the heart of the bogie. Although a groove can be arranged in one or both ends of the longitudinal beam, wherein a downwardly disposed pin, arranged on the carriage parts, can rest, the equator beam is preferably provided with upstanding pins, along which a construction part can shift on a carriage part and wherein this is also rotatable.

By a further developed embodiment, the bearing means, which preferably comprise hingeable knee parts and hingeable arms secured thereto, are arranged sideways with respect to the central axis of the rail vehicle. In this way a tram with a relatively low floor can be realized which provides a large advantage on stepping into the tram.

The present invention also provides a running mechanism for a rail vehicle, comprising a frame and two or more wheel axles arranged on the frame, and a rotatable longitudinal beam arranged near the heart of

the frame for supporting carriage parts on the heart at a longitudinal distance therefrom. With this running mechanism carriages can be used which can be coupled together, for example rotatably, by means of coupling  
5 means.

Preferably a carriage according to the present invention, is supported near the middle of the longitudinal sleepers of the bogie by means of standards which are rotatably or hingeable arranged on both the  
10 carriage parts and the running mechanism.

According to another aspect of the present invention there is provided a rail vehicle, comprising:

- one or more carriages
- a running mechanism with two or more wheel  
15 axles
- at least one standard, which on one side is hingeable attached to longitudinal sleeper of the frame and on the other side is hingeably arranged on the carriage part at a considerable height with respect to  
20 the frame.

In this way the weight of the carriage is supported as near as possible to the centre of the running mechanism.

The bodywork of the carriage is preferably  
25 synthetic, which considerably decreases the weight thereof. Accordingly the energy required for the traction is also limited, while the amount of maintenance needed is reduced.

A hingeable transverse beam is preferably  
30 arranged on the standard, which is provided on both ends thereof with hingeable arms, which on the other sides thereof are hingeable arranged on the carriage parts. Thanks to this construction it is possible, also in the case of a tram with a low floor, to follow all the  
35 movements of the carriages with respect to each other, wherein the weight thereof remains supported on the middle piece of the longitudinal sleepers of the chassis.

Further advantages, characteristics and details of the present invention will be clarified with respect to the following drawings, which show:

- 5 - figure 1 a partially broken away perspective view of a first preferred embodiment of a rail vehicle and bogie according to the present invention;
- figure 2 an above view to clarify the working of the rail vehicle shown in figure 1;
- 10 - figure 3A-D respective, schematic views of the rail vehicle according to figure 1 and 2, which are pulled forward within a profile of available area;
- figure 4a perspective view partly broken away of a further embodiment of a rail vehicle according to the present invention; and
- 15 - figure 5A-C respective views of the further preferred embodiment.

A preferred embodiment of a rail vehicle 10 with a running mechanism 12 (figure 1 and 2) comprises two schematically shown carriage parts 11 and 13 (for 20 example having a length of around 6,5 m and a breadth of around 2,3 m) where between a harmonica structure can extend with which the interior of the vehicle parts 11 and 13 are joined to one another.

The running mechanism 12 comprises two wheel 25 axles 15 and 16 of which the wheels 17 can roll over rails R. The wheels are suspended in longitudinal sleepers 18, 19, where between a transverse beam construction 20 extends. Near the heart of the bogie a so called equator beam 21 is rotatably arranged on the 30 transverse construction which is provided on both sides with pins 22 and 23 respectively about which ears 24 and 25 respectively are arranged on the vehicle parts 13 and 11 respectively, which are rotatable. A grove like hole 26 is arranged in ear 24.

35 The vehicle parts 11 and 13 are furthermore rotatably joined to each other via V-shaped beams 30, 31, which can both turn on a common axle 32.

By another not shown preferred embodiment, both carriage parts can be shiftably supported on bearings for forcing the vehicle parts towards and away from each other.

5           The vehicle part 13 of the embodiment shown in figures 1 and 2 is furthermore provided with protruding plate parts 40 and 41 on which straight upstanding rods 42, 43 respectively are hingeably or rotatably arranged which on the other rotatably or hingeably are arranged  
10 near the middle of the longitudinal sleepers 18, 19 respectively. In this way the weight of the carriage part 13 is supported as well as possible on the running mechanism 12. Spring elements 44, 45 respectively are preferably associated in or on the rods 42 in order to  
15 compensate for differences in length of the rods, which can occur during passage around a bend or on a hill.

As will become especially clear in the view from above of figure 2, on pulling the carriage parts 13 and 11 through a bend shaped rail part, the hingeable  
20 axle 32 is moved from the heart of the bogie 12, whereby the grove like hole 26 displaces itself in the ear 24, also somewhat in the direction of the vehicle part 13, whereby swaying out of the vehicle parts 11 and 13 is restricted with respect to each other. Furthermore in  
25 this manner the walk through area remains well defined between the vehicle parts, which is advantageous for wheel chair users and passenger with prams and the like.

It will be clear that the above described running mechanism can be arranged at one or more  
30 locations of different assemblies of trains or trams. In figures 3A-D a configuration is shown wherein such a running mechanism is arranged between the middle wagons 11 and 13, whilst the front and rear wagons of the tram are provided with a ridged or rotatable running  
35 mechanism. In figures 3A-D an available area having the size of  $d$  is present on both sides of a heart line  $H$  shown with a slash-dot line. As is apparent from figures 3A-D, wherein a somewhat S-shaped bend is shown, the

carriage parts 11 and 13 remain within the available free area, defined by the broken lines.

In a further preferred embodiment (figure 4A-C), a rail vehicle 50 comprises two carriages parts 51 and 52 which are rotatably joined together and where between a gangway 53 is created above a rotation disk 54. On both sides of the gangway 53 bellow parts 55, 56, 57 and 58 are to be found.

The carriage parts are preferably light in weight and for example constructed of synthetic material, which can lead to a saving in weight with respect to existing rail carriages of around 20%, whereby a considerable saving in energy is provided. The underside of the synthetic bodywork of the carriage parts is preferably arranged as close as possible to the ground in which the rails are arranged, to thus provide easy entrance and exit to and from such a tram, in the present embodiment at a height  $h$  of roughly 320 mm. At the entry doors of the carriages the floor can be locally lowered to for example 240 mm above the road, so that the aged and wheel chair bound can easily access the tram.

In order to support the weight of the bodywork of the carriages 51 and 52 on the chassis 60, tree like support constructions 61 and 62 are arranged on both sides of the gangway 53 between the bellow parts, which also have to be guided, or secured, underneath the bodywork, which each comprise a standard 63, which is secured via a spring element 64 to the chassis 60. Furthermore a transverse arm 66 is secured via a ball hinge 65 to the end of the standard 63 whilst downwardly directed arms 69, 70 respectively are arranged on the ends of the transverse arms 66 via ball hinges 67 and 68, which arms 69, 70 are in turn via the ball hinges 71 and 72 secured to the ears 73, 74 respectively on the carriages 51 and 52 respectively. This support construction enable the desired movements of the carriage parts with respect to each other in S-bends, on inclines and leanings possible, wherein the weight of the



carriages is supported on the chassis and wherein the underside of the carriage parts is prevented from contacting the ground in practically occurring inclines.

Just as with respect to the embodiment shown in 5 figures 1 and 2, the swaying out of the carriages outside of the available free area is prevented by a construction which reduces swaying out of the carriages through bends.

Since the area below the gangway 53 is limited in the described preferred embodiment, this construction 10 is arranged on one side, in the present case, between the bellow parts 57 and 58. This construction comprises two knee parts hingeably arranged on the chassis and arms 83 and 84 hingeably secured thereto, which are hingeably arranged on the other side to the carriage 51, 52 15 respectively. These components form together the same working as an equator beam provided with a groove as shown in figures 1 and 2, i.e. that the carriages 51 and 52 are forced towards one another in a bend.

The present invention is not limited to the 20 above described preferred embodiment thereof; the requested rights are determined by the following claims, within the range of which many modifications are conceivable.

**CLAIMS**

1. Rail vehicle, comprising:
  - two or more carriage parts;
  - a running mechanism having a frame and two or more wheel axles;
  - 5           - bearing means arranged substantially longitudinally at a distance from the heart of the frame for supporting the running means on the frame, wherein at least one of the carriage parts is substantially movable in a longitudinal direction with respect to the bearing
  - 10 means; and
    - coupling means arranged on the carriage parts for rotatably coupling the carriage parts to one another.
2. Rail vehicle according to claim 1, wherein the frame comprises longitudinal sleepers and a
- 15 transverse beam construction and the bearing means comprise a longitudinal beam rotatably arranged on the transverse beam construction.
3. Rail vehicle according to claim 2, wherein the longitudinal beam is formed by an equator beam having
- 20 two upstanding pins, wherein the first pin is rotatably connected to the first carriage part, whilst a second pin is rotatably and shiftably joined with the second carriage part.
4. Rail vehicle according to claim 1, 2 or 3,
- 25 wherein the couple means comprise a first beam being substantially V-shaped when viewed from above on a first carriage part and a second V-shaped beam being substantially V-shaped when viewed from above, wherein both V-shaped beams are arranged on a common rotation
- 30 axle.
5. Rail vehicle according to any of the proceeding claims, provided with at least one standard, which on one side is hingeably arranged on a longitudinal

sleeper of the frame and on the other side is arranged on a carriage part at a considerable height with respect to the frame.

6. Rail vehicle according to claim 5, wherein  
5 the standard is provided with a spring element.

7. A running mechanism for a rail vehicle comprising a frame and two or more wheel axles arranged on the frame, and a longitudinal beam, hingeably arranged near the heart of the frame for supporting carriage parts  
10 on the heart at a longitudinal distance therefrom.

8. A running mechanism according to claim 7, destined for a rail vehicle according to any of the claims 1 - 6.

9. Rail vehicle comprising:  
15 - one or more carriage parts;  
- a running mechanism with a frame and two or more wheel axles;  
- at least one standard which is hingeably arranged on one side on the frame and on the other side  
20 is hingeably arranged on a carriage part on a considerable height with respect to the frame.

10. Rail vehicle according to claim 1, 5, 6 or 9, wherein the bearing means are arranged obliquely with respect to the heart line of the rail vehicle.

25 11. Rail vehicle according to claim 10, wherein the bearing means comprise two angular arms, hingeably arranged on the chassis, as well as two hingeable arms arranged thereon, which on the other sides of the respective carriage parts are arranged.

30 12. Rail vehicle according to any of the proceedings claims 1-6, 9, 10 or 11, wherein the carriage parts comprise a synthetic bodywork.

13. Rail vehicle according to claims 5, 6, 9, 10, 11 or 12, wherein a hingeable transverse beam is  
35 arranged on the standard, which is provided at both extremities thereof with hingeable arms, which are hingeably arranged on the carriage parts.

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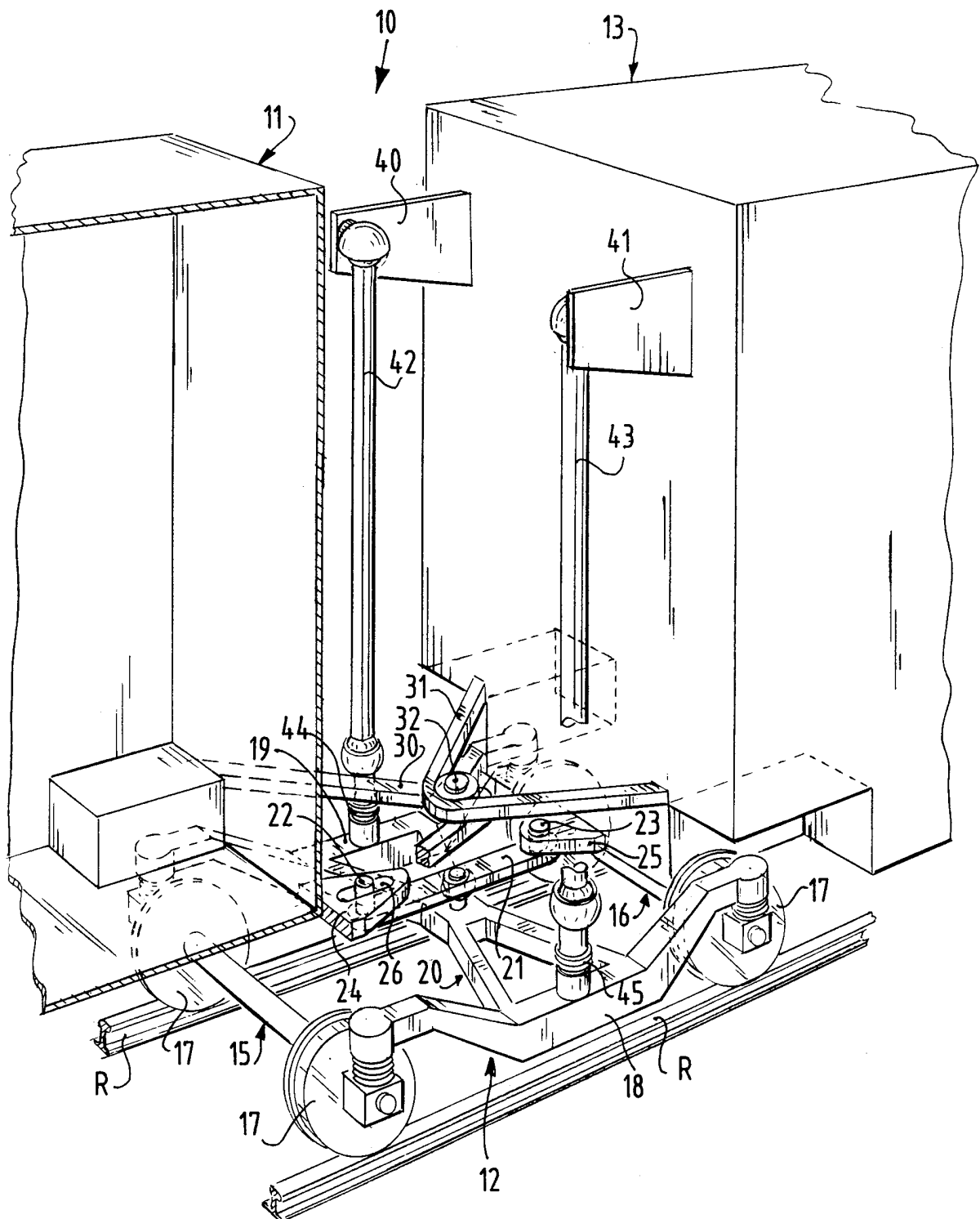


FIG.1

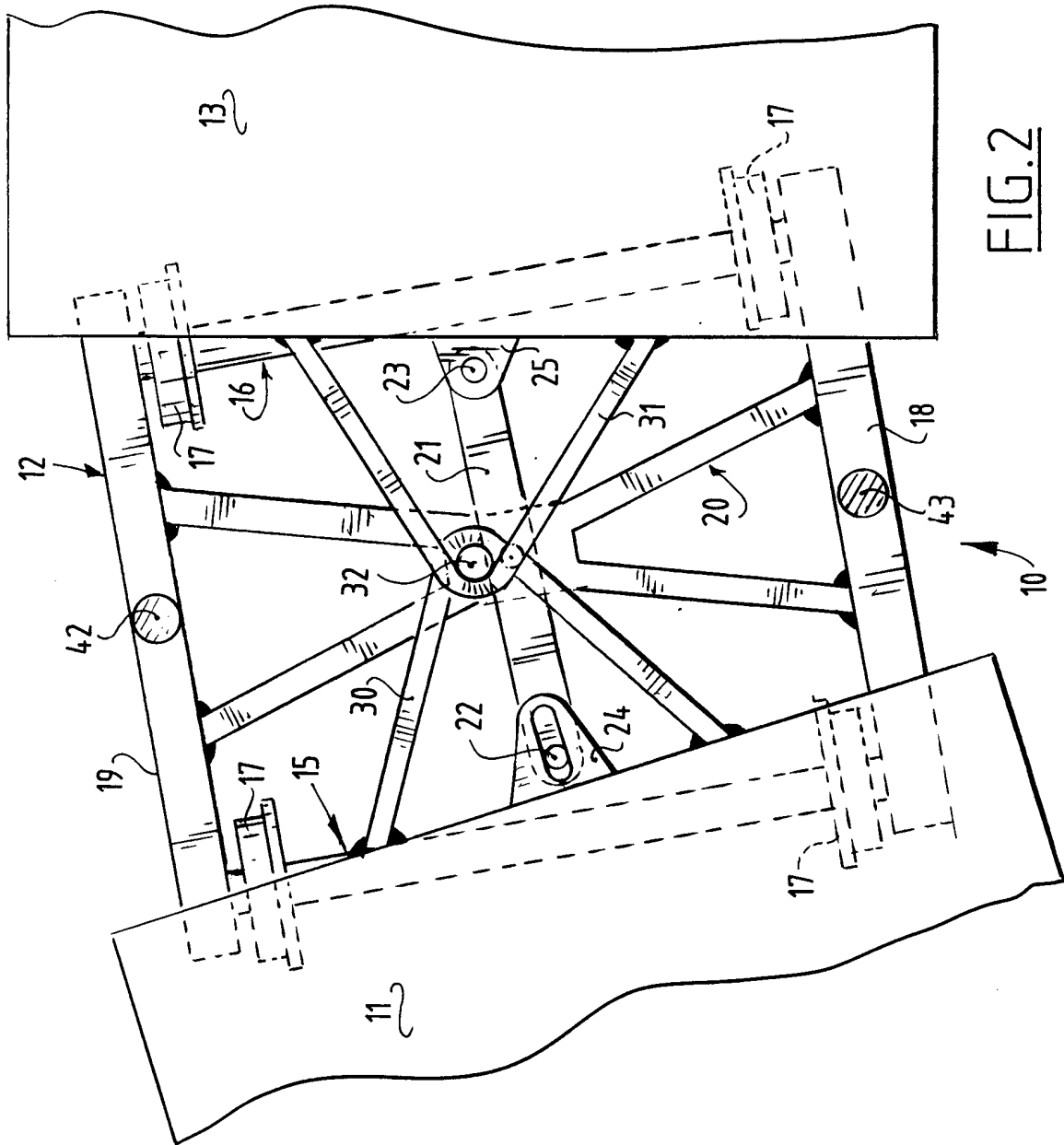
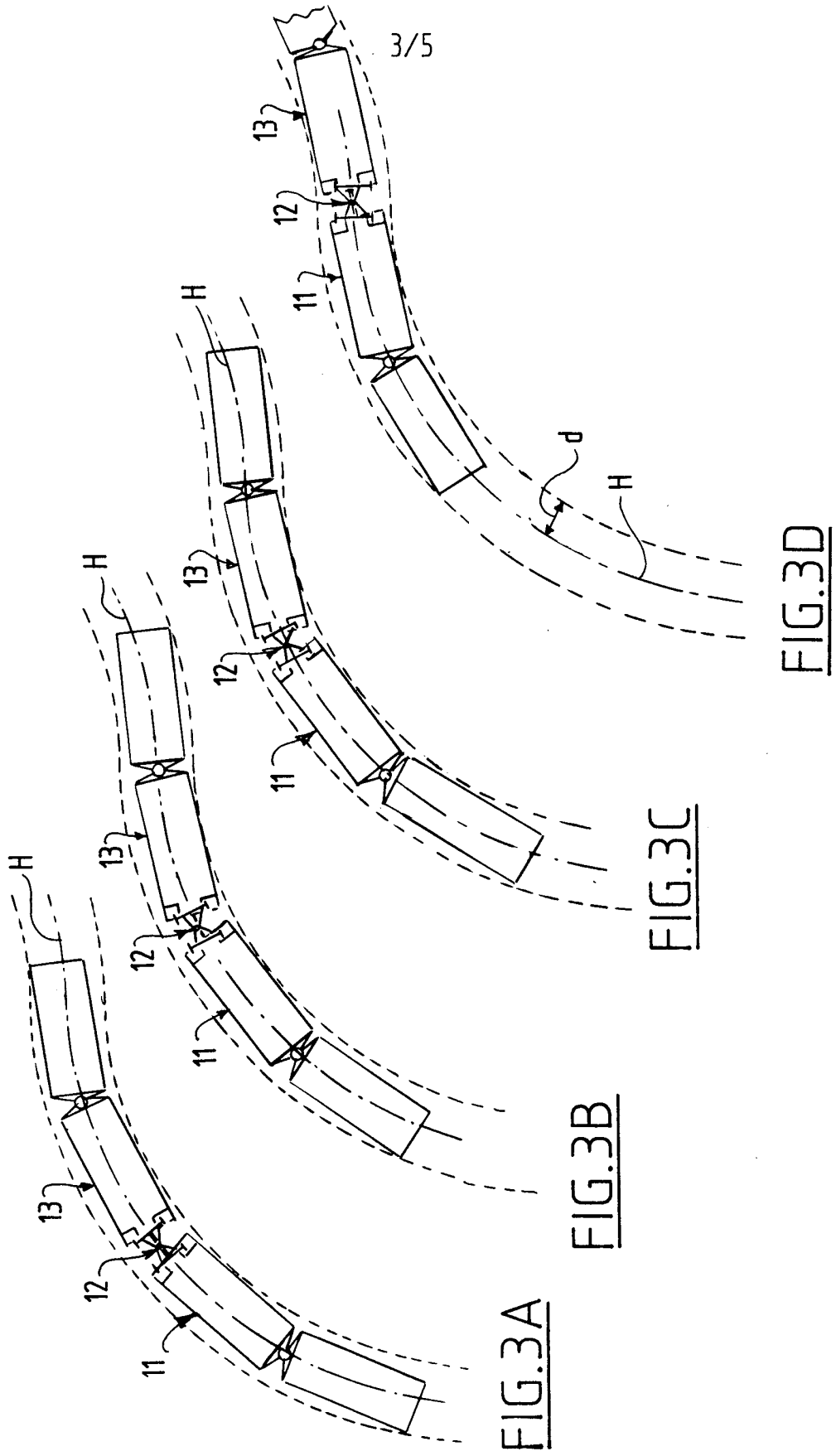


FIG. 2



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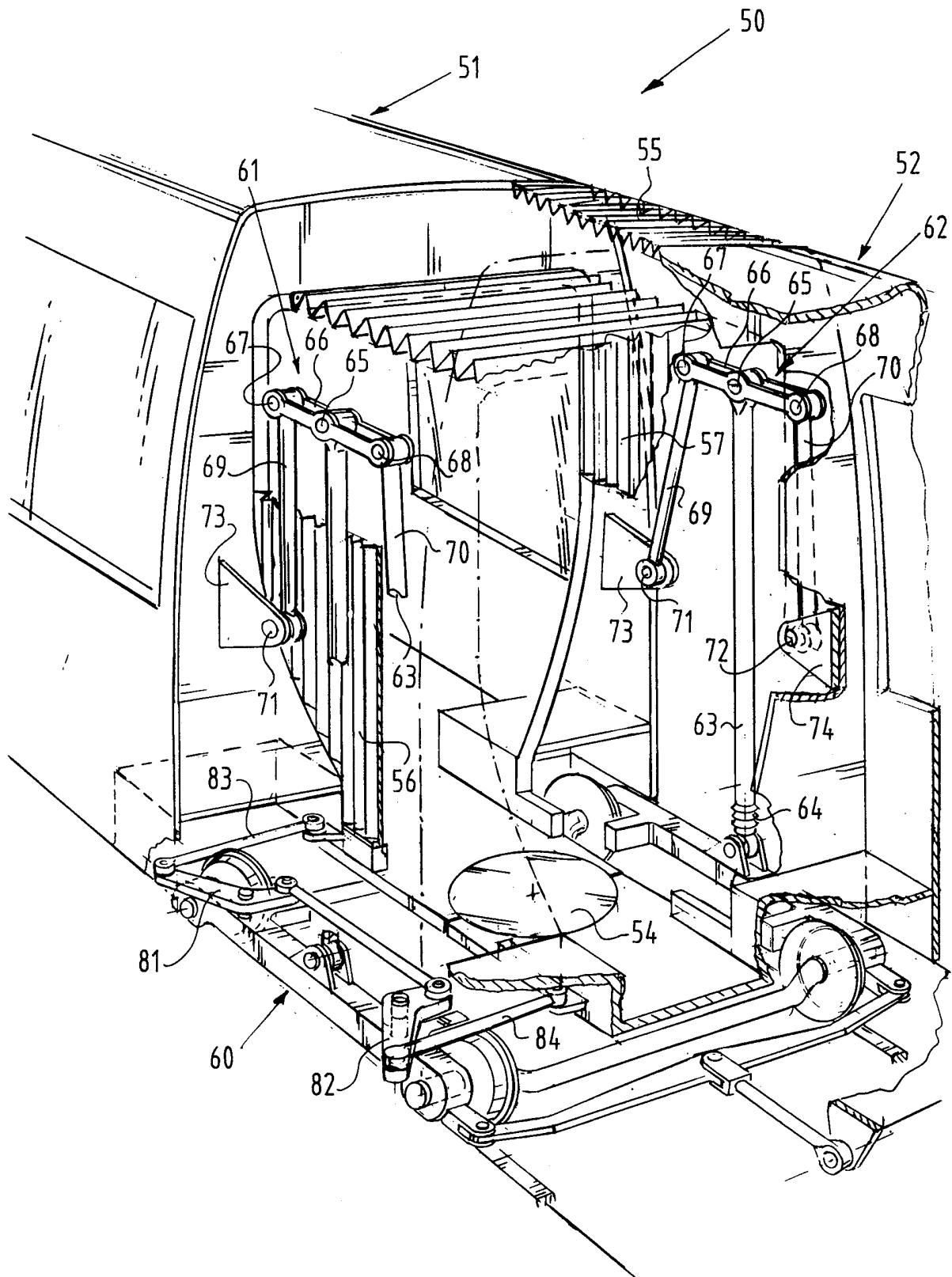


FIG. 4

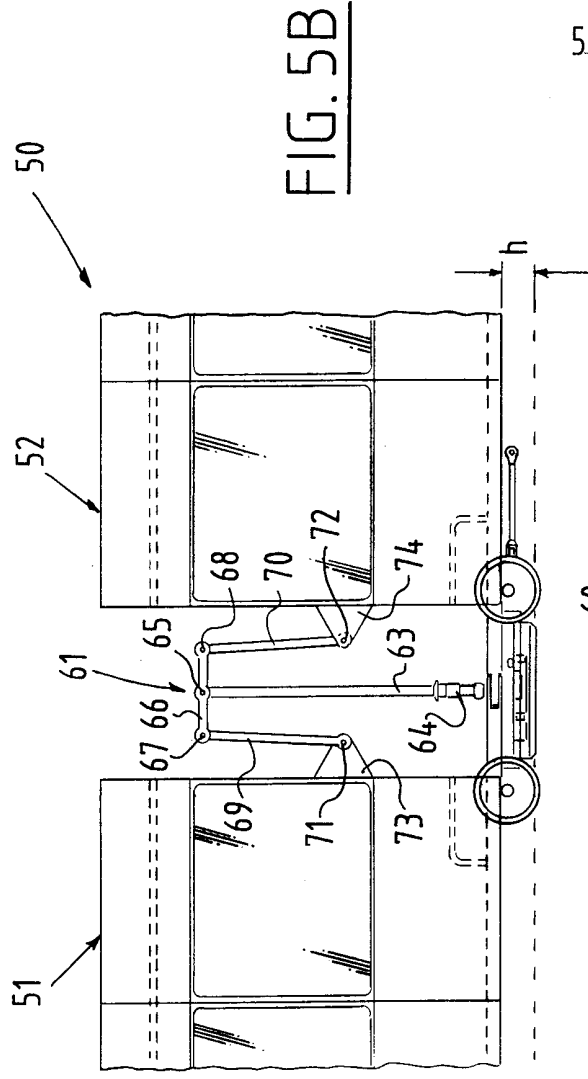
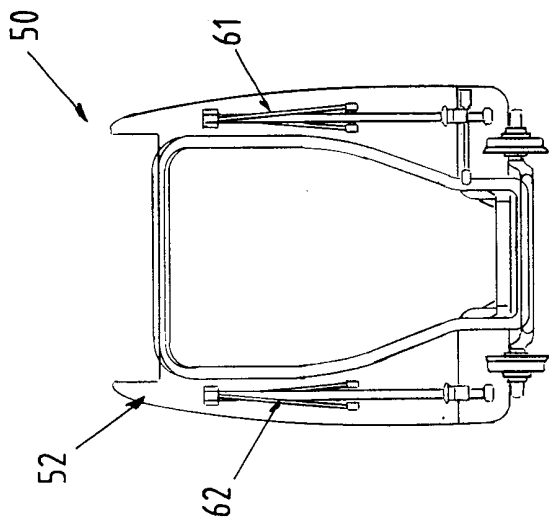


FIG. 5B

FIG. 5A

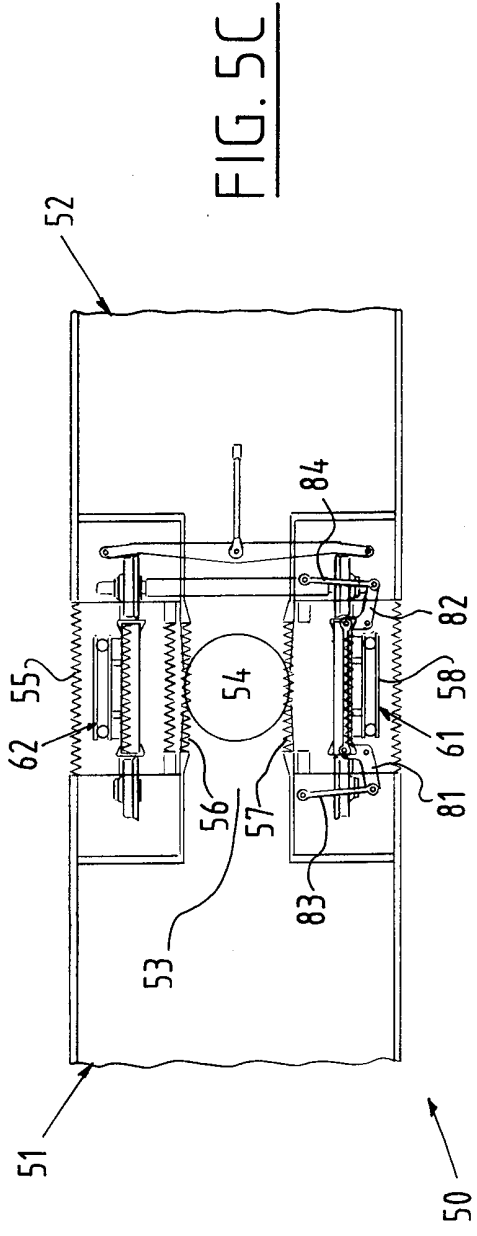


FIG. 5C



# INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 99/05330

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC 7 B61F3/12		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b>		
Minimum documentation searched (classification system followed by classification symbols) IPC 7 B61F B61D		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used)		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CH 370 432 A (INVENTIO AG) 30 August 1963 (1963-08-30) the whole document ---	1
A	FR 2 126 781 A (BRITISH RAILWAYS BOARD) 6 October 1972 (1972-10-06) cited in the application page 3, line 24 -page 5, line 30; figures 3-6 ---	1
A	DE 552 538 C (ORENSTEIN & KOPPEL AG) 15 June 1932 (1932-06-15) the whole document ---	1
A	GB 2 270 663 A (POWELL DUFFRYN STANDARD LTD) 23 March 1994 (1994-03-23) page 6, line 10 -page 8, line 19; figures 1-6 -----	1
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# INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter. nal Application No

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