

EUROPEAN PATENT APPLICATION

Application number: 87201501.1

Int. Cl.4: B61F 5/30 , B61F 5/38

Date of filing: 06.08.87

Priority: 06.08.86 DK 3737/86

Date of publication of application:
06.04.88 Bulletin 88/14

Designated Contracting States:
AT BE CH DE ES FR GB GR IT LI LU NL SE

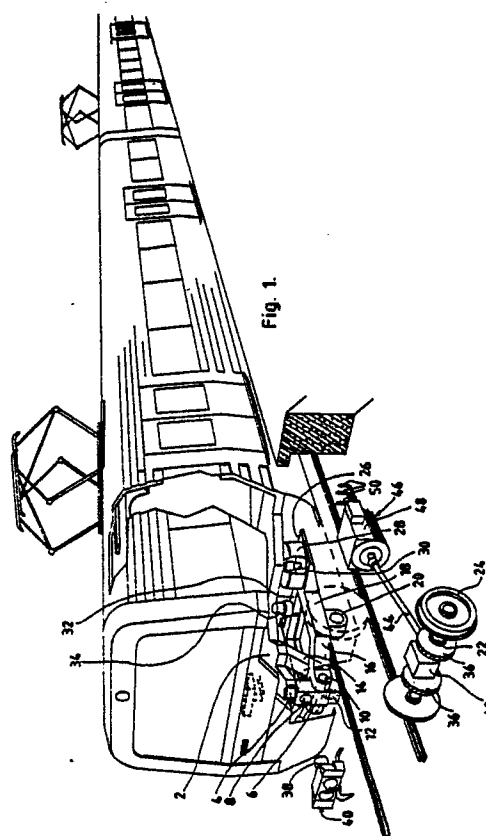
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Railroad car with driving bogies.

Railroad cars, e.g. in electrically driven local trains, are normally provided with a double axle bogie at each end, whereby the car ends will be pronounced projecting from their associated carrier engagements with the bogies. Several acknowledged drawbacks are encountered hereby, e.g. the car ends being subjected to lateral impacts when driving between straight and curved track portions. With the invention a smooth driving is obtained by the car bogie at each end of the car being made as a single axle bogie (10,16,18) comprising a bearing block (6), which is mounted immediately at the car end and provided with rearwardly and outwardly projecting bogie arms (16, 18) carrying the driving wheels (24) and being both vertically and laterally pivotable about the bearing block (6) against the action of spring means (28) interposed direct between the car bottom (2) and a free end of each bogie arm (18). The bearing block (6) may carry a forwardly exposed automatic coupling part (40), which will always assume an optimal position, because its longitudinal direction will coincide with the tangential direction of the rail track.



Railroad car with driving bogies.

The present invention relates to a bogie supported railroad car, notably for use in electrically driven trains for local traffic. Usually such cars are carried resiliently on two fourwheel bogies located near the respective opposite ends of the car in such a manner that the car may pivot about a vertical middle axis of the bogie as well as about a horizontal, transverse middle axis of the bogie and to a certain extent also about a longitudinal middle axis thereof, whereby a certain mutual movability between the bogie and the car is required. The use of such bogies involves various constructional and operational conditions, of which some may be designated drawbacks so far as they are found to be improvable.

The invention has the primary object of providing a bogie supported car having a bogie system, which is improved in several respects.

The car according to the invention is supported, immediately at each end thereof, on a central front block, which is rotatable about a vertical axis and constitutes a bearing block for a pair of rearwardly and outwardly projecting wheel carrier arms, which are pivotable about a horizontal transverse axis and are each provided with a shaft bearing for an associated driving wheel and being in carrier connection with the respective car end bottom through a compression spring member. Thus the bogie will be a two-wheeled bogie, which despite its firm carrier connection with the car end through the said front block may nevertheless support the car in a resilient manner, just as the required degrees of freedom with respect to the mutual movability between the car and the bogie or rather the driving wheels thereof will be secured.

This basic concept, in which the said front block plays the role of a universal joint, offers several advantages compared with conventional bogies:

1) The unbiased mass of the bogie is essentially reduceable, whereby a calm driving is achievable,

2) The total weight of the bogies will be reduced, resulting in a car of reduced weight.

3) The mounting of the carrying block immediately adjacent the car end involves that the car end will always be located just above the driving rails, whereby the car will always, on a curved driving track, form a chord or tangent to the curved track, without the car ends projecting laterally outside the curved rails. Such a projection occurs with the use of conventional bogies, where the pivot connection between the bogie and the car is bound to be located somewhat inside or behind the end of the car, such that also the two foremost wheels can

be located behind the car end for enabling two cars to be coupled together. The specified mounting of the front block according to the invention has a significant advantage in conditioning a smooth driving in the transitions between straight and curved rail portions, because the intercoupled car ends will follow the rail track without being laterally displaced therefrom; conventionally the front end of a straight running car may be subjected to strong lateral impacts when its preceding car enters a curve, and the rear end of the preceding car is influenced by a corresponding reaction effect.

4) For the coupling together of the cars it is greatly advantageous that the car ends per definition will be located just above the rail track, as there will be no problem, then, with respect to the joining of a car on a straight rail portion with a laterally displaced end of an adjacent car on a curved rail portion.

In that connection the invention provides for a further advantageous possibility, viz. that an automatic coupling unit, well known per se, for the joining of the cars may be mounted in direct association with the said front block, whereby the coupling unit will not only be located generally at the middle of the car end, but also turned in accordance with a possible curvature of the rail track.

5) Also the coupling unit of an adjacent car will be correspondingly turned, when the cars stand on an entirely or partly curved track, whereby the units will be immediately interengageable, without notice having to be taken of possible variations of the lateral positions relative the track.

When the areas of support between the bogies and the car are located closer to the car ends it may be natural to consider a reduction of the length of the cars. Conventionally a passenger car has a length of about 20 m, and in connection with the invention it has been found suitable to reduce the length to some 15-16 m, corresponding approximately to the distance between the carrier areas of conventional bogies. In a preferred design of a car according to the invention (not disclosed here in more detail) the cars are made without special driver's compartments at the ends, as the car ends are only provided with connector means of small space requirements for a mobile control desk, such that all car ends but only the foremost one will be usable for accommodating passengers. Hereby the passenger capacity of the cars may be unchanged even for a reduced car length.

6) The invention even provides for an associated possibility of increasing the width of the cars and thereby further compensating for the space narrowing by the said length reduction of the cars.

An increased width is made possible because the cars may extend as pure chords along curved track portions, whereby the platforms of the railway stations may be designed without the otherwise required free space for the car ends to be noticeably laterally displaced from the rail track along curved tracks. Also, the middle portions of the cars should extend tangentially to a curved platform edge without the car ends being located inconveniently spaced from that edge. Thus, shortened cars of increased width will be usable in connection with already existing platform constructions.

7) Irrespective of an optionally increased car width the reduced length of the cars will involve a reduced axle load.

Preferably the said automatic coupling unit is made as a coupling block, which is connected with the said carrier front block in a pivotal manner so as to be limited freely rotatable about a longitudinal horizontal axis.

8) Hereby the coupling will be directly usable also in situations where two cars to be coupled assume mutually different lateral inclinations, this so far having required flexible designs of the coupling parts themselves.

The resilient means for carrying the car end on the rearwardly projection bogie arms may, according to the invention, be constituted by simple air cushion springs with associated shock absorbers, and by relieving the springs the weight of the car may operate a hydraulic cylinder serving as an actuator for the wheel brakes, whereby separate oil pumps for the brake system are made superfluous. The air cushion springs may be designed as lateral stabilizers, which will well allow for controlled relative turning of the bogie, but also make the bogie self-centering and prevent oscillations thereof.

The two bogie arms may be interconnected through a torsion bar, whereby the car may carry out resilient lateral tiltings with good bed support.

For use in connection with the bogie system of the invention has been developed a new driving system comprising a water cooled electric motor, which is tightened directly to the car bottom with a noise reducing intermediate layer in a position on the opposite side of the two driving wheels relative the front block. The motor is drivingly connected with the wheels through a flexible shaft driving on a wheel differential, the use of such a differential having been found to imply a surprisingly high reduction of the wear of the wheels. The use of a water cooled motor is highly advantageous i.a. in that the car may be designed without the otherwise conventional, heavily dimensioned ventilation channels for supply of cooling air from above.

It is preferred to generally construct the car according to the invention with a relatively small weight, and to this end the car is preferably provided with a simple emergency current generator driven by a small diesel or petrol motor, this being an installation which is much lighter than the accumulator batteries traditionally used for this purpose.

In the following the invention is described in more detail with reference to the drawing, in which:-

Fig. 1 is a perspective view, partly in section, of a car according to the invention, and

Fig. 2 is a side view of two intercoupled cars

The car end as shown in a detailed manner in Fig. 1 has a car floor 2, which at the extreme car end has a vertical pivot pin connection 4 with an underlying bearing block 6 having a forwardly open hole 8 and an underlying receiver hole for a transverse pin 10. At its lower end the bearing block 6 is supported by a vertical pivot pin 12 received in a carrier bracket 14 depending from a rigid connection with the car floor or bottom 2.

The transverse pin 10, which is a torsion bar, is on each side of the block 6 connected with a rearwardly and outwardly projecting bogie arm 16 continuing rearwardly in a straight portion 18 having frontwise a lower bearing 20 for a driving wheel shaft 22 with associated driving wheels 24 and rearwise having an upper support surface 26 for an air cushion spring 28 arranged between this surface and the car bottom 2. The air spring 28 is shaped as a short or low cylindrical member, the opposite plane sides of which are secured to the respective adjoining surfaces, such that the spring member or members will be resilient not only in the vertical direction, but also in transverse horizontal direction, whereby a suitable damping of the lateral pivotability of the bogie arms 16,18 about the vertical axis defined by the pivot pins 4,12 of the block 6 will be obtained.

Inside each of the air cushion springs is arranged a shock absorber 30.

Between the rear ends of the bogie arms 16,18 is mounted a connector beam 32 carrying at its middle portion a hydraulic pressure cylinder 34 having its top end located slightly underneath the car bottom 2, such that it will be loaded with the weight of the car when the air is let out from the spring members 28. The cylinder 34 constitutes a hydraulic pressure source for the brake system of the car, this system comprising conventional disc brakes with discs 36 and associated, non-illustrated spring biased braking cylinders. The partial weight of the car resting on the actuator cylinder 34 will at any time be sufficient to actuate the wheel brakes whenever operated by the train pilot or by the

pulling of an emergency brake lever, and a special pump for the brake system will thus be superfluous. The braking is terminated by pumping air into the spring members 28.

The forwardly open hole 8 in the block 6 is used for receiving a horizontal carrier stub 38 on an automatic coupling block 40 of an otherwise conventional design. Thus, in its mounted condition this block may rotate on or about the stub 38, though in a non-illustrated manner the block 40 is spring biased towards a horizontal transverse position in its free condition, whereby the car is easy to couple together with a corresponding car, even if the cars are mutually laterally tilted.

It will be readily appreciated that the car end may carry out any required rotation in the horizontal plane relative the bogie 16, 18, 10 viz. about the pins 4 and 12, and that the car end will be resiliently supported on the driving wheels 24, viz. by the vertical pivotability of the bogie about the transverse bar against (or assisted by) the action of the spring members 28. In a manner not shown the bearing block 6 is provided with various shock absorbing means in its connections to the respective adjoining elements.

If the front wheels are driven wheels, as they will normally be, the wheel shaft 22 is provided with a middle differential 42, which is connected with a driving shaft 44 of an electric motor 46 incorporated in a liquid cooling box 48, which is provided with a flat top side, by which the motor box is mounted direct against the underside of the car floor 2, though through an intermediate layer of a shock and sound damping material. The shaft 44 is of the flexible type, constructed e.g. in carbon fibre reinforced polyester, the shaft being connected with both the differential 42 and the motor 46 without the use of universal joints. Thus, the shaft 44 will establish a permanent driving connection during the occurring mutual movements between the differential 42 and the bottom anchored motor 46.

Through thin pipes 50 the motor cooling housing 48 is connected with an upper heat exchanger system (not shown), which comprises means for heat exchanging with both the outer air and the heating system of the car, such that during the wintertime the motor may contribute to the heating of the car.

The use of a liquid cooled motor in the relevant connection is quite unconventional and has been found to present remarkable advantages. For both the construction and the use of the car it is highly advantageous that the otherwise conventional vertical air ducts through the car for supply of cooling air to the motor from above can be eliminated, while the drawing of the narrow pipes 50 is quite uncomplicated and requires a very small space

only. Moreover it has been found that the efficiency of the motor is increased with the use of liquid cooling and that the associated encapsulation of the motor is advantageous for the operational safety of the motor. The liquid filling also contributes to reduce the noise from the motor such that the disclosed very simple mounting of the motor is made practically acceptable.

In Fig. 2 it is clearly shown that the driving wheels 24 may be located very near the ends of the car. When the length of a self carrying car between the bogie supports is maintained based on conventional standards the total car length will hereby be reduced, insofar as the support areas are located directly adjacent the car ends, and the associated car length reduction, as already mentioned, will be advantageous in several respects, particularly in enabling an increased car width and still a reduced weight of the car.

It should be emphasized that the achieved very small transverse movability between two intercoupled car ends involves the considerable advantage that the passenger passages between such cars may be constructed in a highly simplified manner compared with the conventional prior art, and that the car ends may be almost totally open towards each other, such that a train of these cars may have the character of a flexible tube without significant narrowing at the car joints.

Claims

1. A railway car with driving bogies, particularly for electrically driven trains, characterized in that the car immediately at each end thereof rests on a central bearing block (6), which is turnable about a vertical axis and carries a pair of rearwardly and outwardly projecting wheel arms (16, 18), which are pivotable about a horizontal transverse axis (14) through the bearing block, and which are each provided with a shaft bearing (20) for an associated driving wheel (24) and are each arranged in carrying connection with the car bottom (2) through a compression spring member (28).

2. A car according to claim 1, in which there is mounted, in direct connection with the bearing block (6) a forwardly exposed automatic coupling block (40), which is preferably connected with the bearing block (6) in a pivotal manner about a longitudinal axis.

3. A car according to claim 1, in which the opposed rearwardly and outwardly projecting wheel carrier arms or bogie arms (18) are interconnected through a transverse torsion bar (10) through the bearing block (6).

4. A car according to claim 1, in which the compression spring member is constituted by an air cushion spring (28), which additionally serves as an effective resilient element towards lateral horizontal pivot movements of the bogie arms (18) relative the car bottom (2). 5

5. A car according to claim 4, in which the air cushion springs (28) are integrated with shock absorbing means (30) effective at least in the vertical direction. 10

6. A car according to claim 1, in which a hydraulic actuation cylinder (30) is arranged between the car bottom (2) and the bogie arm system (18) for delivery of hydraulic pressure to the wheel brake system (36) of the car. 15

7. A car according to claim 1, in which the driving wheels are shaft connected through a differential (42), which is drivingly connected with a motor (46) through a driving shaft (44) projecting longitudinally between the differential (42) and a motor (46), which is secured to the car bottom (2) and is located behind the driving wheels (24) seen from the respective end of the car. 20

8. A car according to claim 7, in which the driving shaft (44) is of a flexible type and the motor (46) is mounted rigidly against the car bottom (2). 25

9. A car according to claim 1 or 7, in which the driving motor is of a liquid cooled type and is in heat exchange connection with heat exchanging means mounted topwise in the car for heat exchange with either the outer air or the interior air of the car. 30

10. A car according to claim 1 and designed with a conventional distance between the foremost and the rearmost bogie carrying areas so as to be of a correspondingly reduced length, the car correspondingly having a relatively large width. 35

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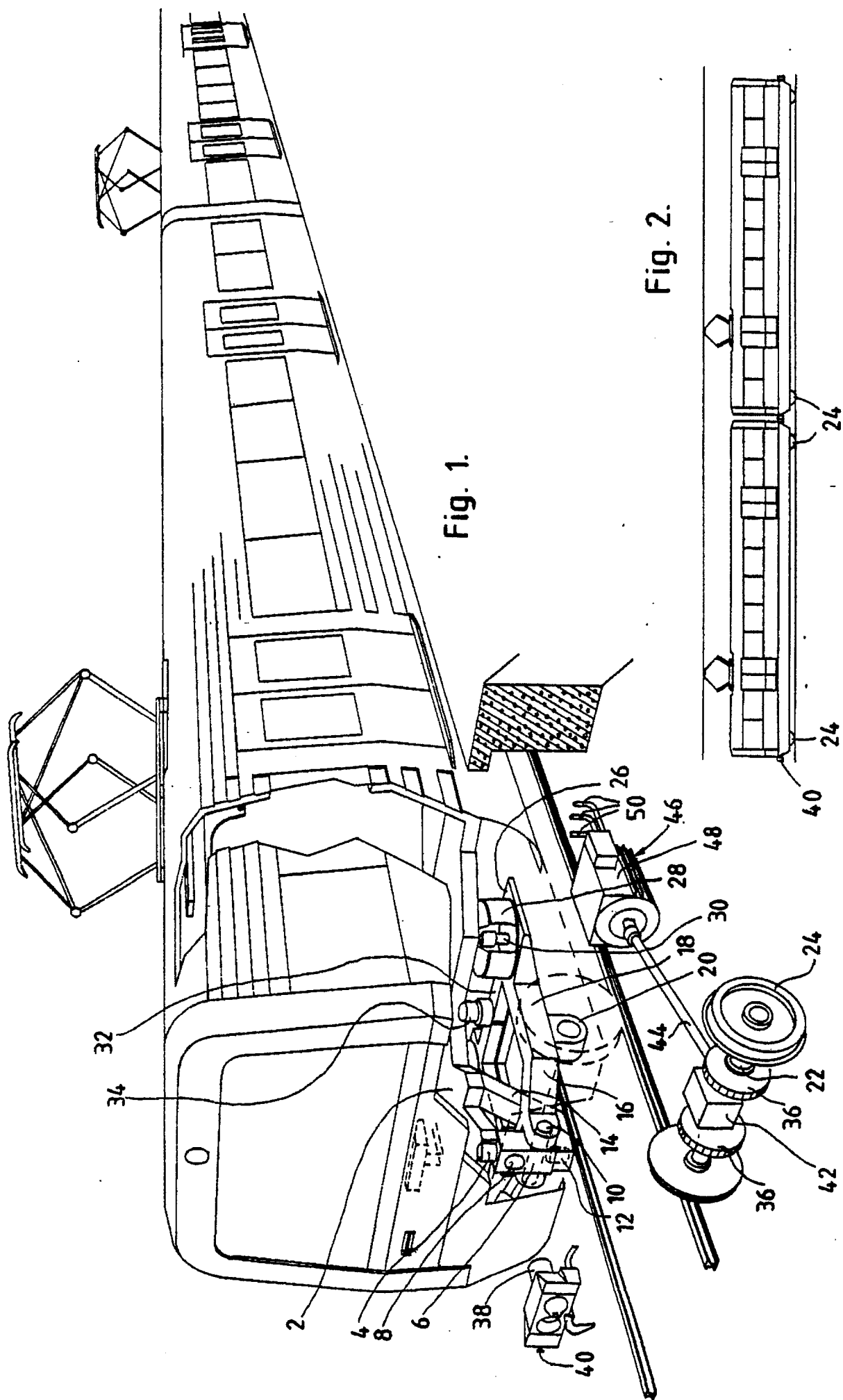


Fig. 2.



EP 87 20 1501

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
X	EP-A-0 161 728 (RMO-WERKSPoor) * Figures 3,4; page 1, line 16 - page 2, line 8; page 3, line 32 - page 4, line 10; page 7, lines 11-15 *	1,4,5	B 61 F 5/42 B 61 C 9/52 B 61 F 5/02 B 61 F 5/30 B 61 F 5/38
A	---	2	
X	DE-B-1 246 012 (KLOSE KG) * Whole document *	1,8	
A	---	7	
A	DE-C- 962 709 (SIEMENS-SCHUCKERTWERKE) * Whole document *	1,8	
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A	CH-A- 126 707 (OERLIKON) * Whole document *	1,8	
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A	DE-B-1 236 348 (LINKE-HOFMANN-BUSCH) * Whole document, especially figure 1 *	1,2	
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A	US-A-4 022 133 (LINDBLOM et al.) * Figures 1,2 *	1	TECHNICAL FIELDS SEARCHED (Int. Cl.4)
A	---		
A	BE-A- 537 996 (ACF INDUSTRIES) * Figure 4 *	1,2	B 61 C B 61 F
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A	MECHANICAL ENGINEERING, vol. 107, no. 10, October 1985, pages 26-36, New York, US; T.H. ENGLE et al.: "Freight train of the future: the integral train" * Figures 1,6-9 *	1	

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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 18-12-1987	Examiner SCHMAL R.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
A	ZEV-GLAS. ANN., vol. 102, no. 5, May 1978, pages 137-142; E. KUHLA: "Der advanced passenger train: programm und innovation" * Figures 3,5 * -----	1,7	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 18-12-1987	Examiner SCHMAL R.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			