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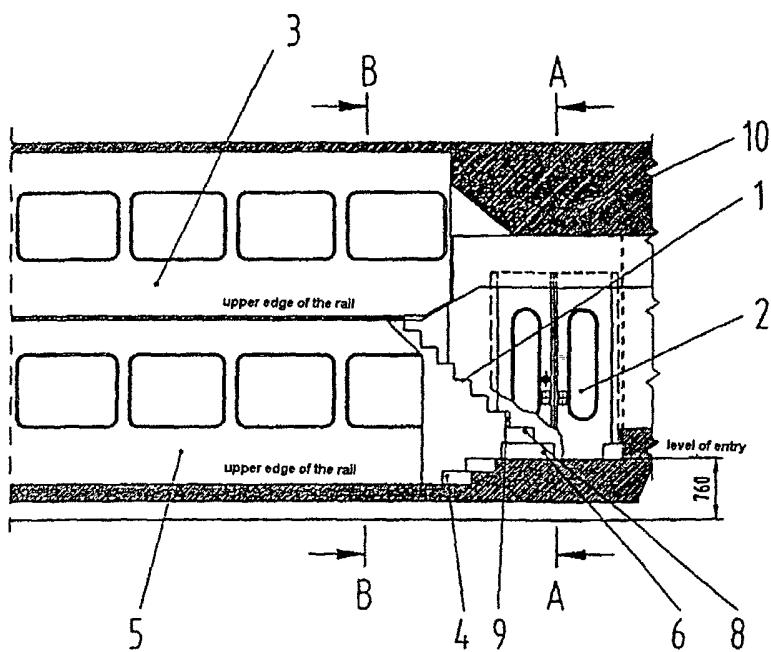
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(54) Title: FLIGHTS OF STAIRS ARRANGEMENT IN A PASSENGER VEHICLE



(57) Abstract: An arrangement and design of flights of stairs in double-decker rail vehicles, in particular rail cars, in which the configuration of the interior is configured, in particular in conjunction with an entry height of 760 mm, in such a way that the problem of inadequate height dimensions in the entry region of double-decker vehicles is solved and an unimpeded exchange of passengers in the entry space (2) is made possible, and direct, unimpeded paths are produced into the large compartments and losses of seating space in the double-decker region are avoided. The stepped approach, provided in the entry space (2), to the two-lane main flight of stairs (1) is characterized by steps which are embodied so as to be arcuate and in the form of terraces and by means of adjoining straight series of steps in the longitudinal direction of the vehicle, the main flight of stairs (1) which is arranged in the centre starting approximately in the centre of the entry space (2) and

leading into the upper deck (3), single-lane secondary flights of stairs (4) to the left and right of this main flight of stairs (1) leading to the lower deck (5). The arrangement and design of the flights of stairs is preferably provided for rail vehicles with an entry height of approximately 760 mm above the upper edge of the rail.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

FLIGHTS OF STAIRS ARRANGEMENT IN A PASSENGER VEHICLE

The present invention relates to a passenger vehicle having a stairway for passengers, in particular a vehicle having a plurality of decks or floors, especially a
5 double-decker vehicle such as a train.

In order to accommodate an increasing number of passengers, it is now becoming more common for passenger vehicles to comprise two or more decks or floors for providing passenger compartments. One example is the use of train carriages
10 having two floors, one arranged above the other: so-called "double-decker" carriages. While such arrangements allow for an increased number of passengers to be accommodated, such an arrangement of decks or floors is not without its problems. One particular problem is to arrange access to both floors or decks from
15 a single entrance level. Traditionally, movement from one level to another within a vehicle, such as a carriage of a train, has been made possible by the use of stairs. However, it has become increasingly difficult to arrange the stairs, so that passengers entering and leaving the upper and lower floors or decks can move
swiftly, easily and unhindered to the exit level. The problem is particularly acute during peak travel periods.

20 Known arrangements for flights of stairs are composed exclusively of straight or slightly curved stepped segments. Depending upon the arrangement of the entry doors (high-level entry or low-level entry), arrangements with two flights of stairs or three flights of stairs are generally provided in different ways in double-decker
25 passenger carriages, in order to connect the upper deck and lower deck.

One design of rail carriage has an entry leading into an entry area. The entry is arranged 760 mm above the track. This is a so-called low-level entry design. While attempts to provide access from the low-level entry area to respective upper
30 and lower decks, these have not been without their problems.

DE 44 23 243 C2 discloses an arrangement and design of flights of stairs in double-decker rail vehicles, in which an off-set stand is provided. The stand is elliptical in shape and half its height is provided between the upper deck flight of stairs and lower deck flight of stairs. The off-set stand follows the shape of the internal contour of the slightly twisted upper-deck and lower-deck flights of stairs. The flight of stairs leading to the upper deck, which starts with an off-centre displacement in the direction of the lower-deck flight of stairs has, over its full width, a stepped angle of the upper step of less than or equal to 20 degrees with respect to the transverse axis of the car.

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A disadvantage with this arrangement of the flight of stairs is that the flow of passengers into the single-decker entry region and into the upper deck can pass only via the two-lane flights of stairs so that the flow of passengers is subject to congestion at the lower-deck flight of stairs. This is particularly the case when passengers are leaving the upper deck and the single-decker region. The speedy movement of passengers into and out of this double-decker railcar is therefore possible only to a limited degree, having an adverse affect on the stop times at stations and on the travel times in general.

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DE 94 21 209 U1 discloses a double-decker rail vehicle in which an entry region is embodied as a standard entry with a possibility of access via a flight of stairs to the lower deck and a flight of stairs to the upper deck. An alternative entry region is embodied as a low-level entry with a possibility of access to the upper deck via the single-decker region by means of a system with three flights of stairs.

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In this arrangement, it is disadvantageous that as the passengers walk they generally head directly for the straight series of steps and walk on them at a right angle, which adversely affects the flow of passengers. In the single-decker region, the flow of passengers is greatly restricted by a direct reversal of direction through 180° when a straight flight of stairs is employed.

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DE 295 07 057 U1 discloses a double-decker rail vehicle with low-level entries, in particular for double-decker centre cars or driving trailers, in which rail vehicle an entry height into the entry regions of a maximum of 760 mm from the upper edge of the rail is provided. The ceiling of the upper deck is extended directly as far as the inner contour of the car roof line above the entry regions, and the floor of the upper deck and the floor of the lower deck approximately following the dimension by which the ceiling of the upper deck is raised in this region.

This known solution for a low-floor entry with 760 mm entry height and a known system with two flights of stairs has a number of disadvantages. The need to comply with the predefined vehicle delimitation profile and fulfilment of the ergonomic requirements (headroom/height of the space) requires all the vehicle levels to rise at the same rate, as a result of which the ceiling of the upper deck must be made to extend directly to the body shell of the vehicle. The necessary slopes in the floor must therefore be made steeper and longer. For this reason, it is not possible to arrange luggage racks in the upper deck in the described region above the entry space. In this region, the ceiling air duct must be arranged in the side wall above the window and then be routed in a complex fashion into the centrally arranged ceiling duct.

In all three prior art systems of stairs it is equally disadvantageous that the possible height dimensions in the entry space are limited and the flights of stairs can only be accessed at a right angle with respect to the steps of the flights of stairs, which has an adverse affect on the flow of passengers.

There is therefore a need to configure the internal space of multi decked vehicles, in particular in conjunction with a low entry height, such as 760 mm, in such a way that the problem of inadequate height in the entry space is solved and an unimpeded and directed flow of passengers is obtained in the entry space. Further, it is desirable that direct and unimpeded paths into the large compartments are provided.

According to the present invention there is provided a vehicle comprising a plurality of floors for accommodating passengers, comprising an entry space accessible from the exterior of the vehicle, a main flight of stairs connecting the entry space with one deck, a secondary flight of stairs connecting the entry space with a second deck, a first part of a main flight of stairs having a terrace comprising at least one step, the step or a first step of the terrace being arranged on the floor of the entry space in the region of an imaginary central entry line, the secondary flight of stairs being arranged to one side of the main flight of stairs.

10 The advantage of the arrangement of the present invention is that the double-decker region which can be usefully and economically exploited is made larger and the entry can be adjusted to various station platform heights by means of simple modifications.

15 The main flight of stairs is preferably wide enough to accommodate two streams of passengers, passing side by side. This is a so-called "two-lane" staircase. The secondary flight of stairs may be configured to accommodate just a single stream of passengers, or more.

20 In a preferred embodiment, the arrangement has two secondary flights of stairs, one extending each side of the main flight of stairs.

The main flight of stairs preferably connects the entry space with an upper floor or deck of the vehicle. The secondary flight of stairs preferably connects the entry space with a lower floor or deck.

The entry space is preferably substantially level across its entire width. Countersunk steps may be set into the floor in the region of the entry from the exterior.

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The terrace may have any suitable shape or form. Preferably, it is arcuate. Such a form allows for easier access for passengers moving across the floor of the entry space from the entry to the foot of the main flight of stairs.

- 5 The stair arrangement of the present invention may be employed in any passenger vehicle requiring access to one or more floors or decks. The arrangement is most suitable for a rail vehicle, such as a train carriage, in particular a low-level entry carriage having an entry at about 760 mm above the rails.
- 10 Embodiments of the present invention will now be described in more detail, by way of example only, having reference to the accompanying drawings, in which:

Fig. 1: shows a side view of a portion of a double-decker rail vehicle according to one embodiment of the present invention;

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Fig. 2: shows a cross-sectional view along the line A-A of Fig. 1;

Fig. 3: shows a cross-sectional view along the line B-B of Fig. 1;

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Fig. 4: shows a cross-sectional plan view of the entry space of the vehicle of Fig. 1;

Fig. 5: shows a side view of a portion of a double-decker vehicle according to a second embodiment of the present invention;

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Fig. 6: shows a cross-sectional plan view of the entry space of the vehicle of Fig. 5; and

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Fig. 7: shows a cross-sectional plan view of the entry space of a vehicle according to further embodiment of the present invention.

Referring to Figs 1 to 4, the interior of a double-decker vehicle is shown, having a two-lane main staircase 1 leading from the entry space 2 into an upper deck 3. The floor of the entry space 2 is level over its entire width. Single-lane secondary flights of stairs 4, respectively to the left and right of the main flight of stairs 1, lead to a lower deck 5. The stepped approach to the main flight of stairs 1 is displaced into the entry space 2 in such a way that a terrace having a first step 6 is arranged in the region of a central imaginary entry line 7 of the entry space 2. The entry line 7 virtually halves the depth of the entry space 2 and leads approximately from the centre of one entry to the centre of the opposite entry. The first part of the flight of stairs, the first step 6, a second step 8, and a third step 9 are embodied so as to be virtually circular and in the form of terraces. The following steps of the main staircase are straight.

With this arrangement and design of the first segments of the flights of stairs in the entry space 2, a generously dimensioned access which can be accessed from a plurality of sides and which has sufficient degrees of freedom is ensured. The flow of passengers is guided in a fan-fashion to the flights of stairs from a broad access space without impedance. This is in contrast to the known, virtually straight series of steps of the prior art, in which the flight of stairs is approached directly at a right angle. The available length of the double-decker region which can be economically used is utilized to a maximum degree by means of the centrally arranged main flight of stairs 1, which projects into the entry space 2 in a generously dimensioned fashion. With this arrangement and design of the flights of stairs it is possible to vary the height in the entry space 2 and to dispense with disruptive slopes in the floor in the entry space 2.

The secondary flights of stairs 4 to the right and left of the main flight of stairs 1 are preferably arranged at an angle to the transverse axis of the car and thus direct the flow of passengers in a targeted fashion to the entry doors and to the central aisle of the lower deck 5.

In an alternative embodiment, as shown in Figure 7, the secondary flights of stairs 4 have arcuate steps and can have, viewed from the lower deck 5, a circular access 13 to the flight of stairs, which is uninterrupted by the main flight of stairs 1. The passengers can thus move from the entry directly into all the regions of the vehicle (upper deck, lower deck, single-decker region) of the double-decker car. That is to say it is possible to pass from the entry to the main flight of stairs 1, from the entry to the secondary flight of stairs 4, from the entry directly through the entry space 2 to the opposite side, to the secondary flight of stairs 4 lying opposite. The access to the flights of stairs always takes place in a fan-like fashion.

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The arrangement of the flights of stairs also permits the end regions of the cars to be generously equipped with seats. The technical equipment can be arranged in the roof space 10, as shown in Fig. 1. This arrangement of technical equipment is not illustrated in more detail in the associated drawings, but a person skilled in the art is completely familiar with its implementation.

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The transparent configuration of the interior space of the double-decker car is significantly improved by means of the generous ceiling height of approximately 2700 mm in the entry space 2 which is now possible, at the same time permitting a uniform overview of the adjoining passenger spaces, such as the upper deck and lower deck 3 and 5 and of the single-decker region.

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The new solution provides a more flexible integration into the access system through the arcuate and terrace-shaped step segments in the entry space 2. The passengers are permitted to access the main flight of stairs 1 from a plurality of sides. Access from the lower deck 5 to the entry space 2 via the secondary flights of stairs 4, which are arranged to the left and right of the main flight of stairs 1 at an angle with respect to the transverse angle of the car, also permits a directed flow of passengers to the entry doors or to the central aisle of the lower deck 5.

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As shown in Figs 5 and 6, in vehicles with entry heights of 600 mm, the level floor of the entry space 2 is provided in the door region with a countersunk step 12 so that 550 mm high station platforms can also be accommodated.

- 5 The embodiments of the present invention described above and shown in the accompanying figures relate to a carriage for a train. However, the arrangement of stairs and entry space described herein may also be employed in other passenger vehicles, for example buses, where space is also at a premium.
- 10 It will be understood that further and additional modifications to the embodiments shown and described herein are possible without departing from the spirit and scope of the present invention.

List of reference numerals

- 1 - Main flight of stairs (two-lane)
- 2 - Entry space (with level floor over its entire width and depth)
- 3 - Upper deck
- 4 - Secondary flights of stairs (single-lane)
- 5 - Lower deck
- 6 - First step
- 7 - Central entry line (imaginary)
- 8 - Second step
- 9 - Third step
- 10 - Roof space
- 11 - Access to flights of stairs (from lower deck 5 to the entry space 2)
- 12 - Step (countersunk)
- 13 - Secondary flights of stairs (embodied in an arcuate shape)

CLAIMS

1. A vehicle comprising a plurality of floors for accommodating passengers, comprising an entry space accessible from the exterior of the vehicle, a main flight
5 of stairs connecting the entry space with one deck, a secondary flight of stairs connecting the entry space with a second deck, a first part of a main flight of stairs having a terrace comprising at least one step, the step or a first step of the terrace being arranged on the floor of the entry space in the region of an imaginary central entry line, the secondary flight of stairs being arranged to one side of the main
10 flight of stairs.
2. The vehicle according to claim 1, wherein the main flight of stairs is wide enough to accommodate two streams of passengers.
- 15 3. The vehicle according to claim 1 or 2, comprising two secondary flights of stairs, one disposed on each side of the main flight of stairs.
4. The vehicle according to claim 3, wherein each secondary flight of stairs is wide enough to accommodate a single stream of passengers.
20
5. The vehicle according to any preceding claim, wherein the main flight of stairs connects the entry space with an upper deck.
6. The vehicle according to any preceding claim, wherein a lower deck is
25 connected to the entry space by a secondary flight of stairs.
7. The vehicle according to any preceding claim, wherein the floor of the entry space is level across its entire width.
- 30 8. The vehicle according to claim 7, wherein the floor has countersunk steps in the region of the entrance to the entry space.

9. The vehicle according to any preceding claim, wherein the terrace is arcuate in form.

10. The vehicle according to any preceding claim, being a rail vehicle.

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11. The vehicle according to claim 10, wherein the rail vehicle has a low-level entry into the entry space from the exterior.

12. The vehicle according to claim 11, wherein the entry is 760 mm above the
10 upper edge of the rail upon which the vehicle runs.

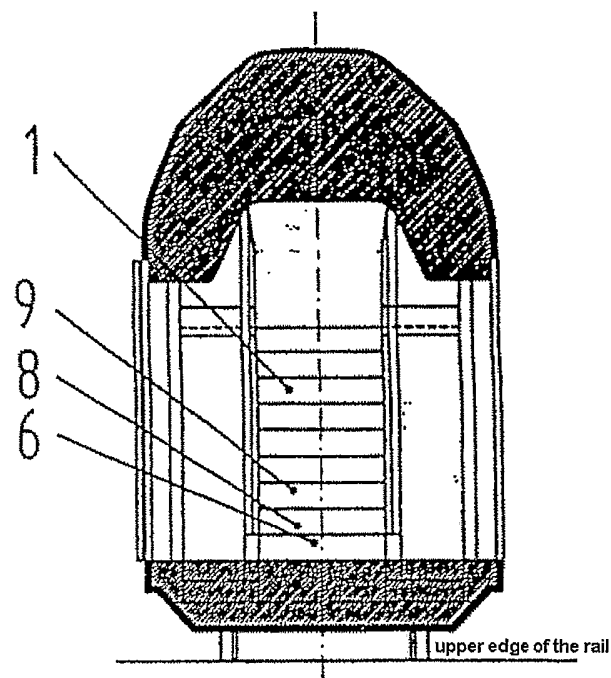


Fig.2

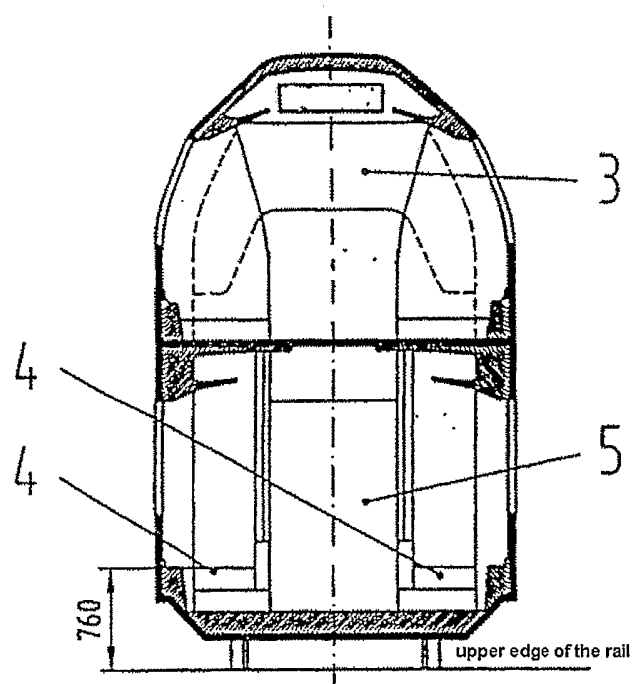


Fig.3

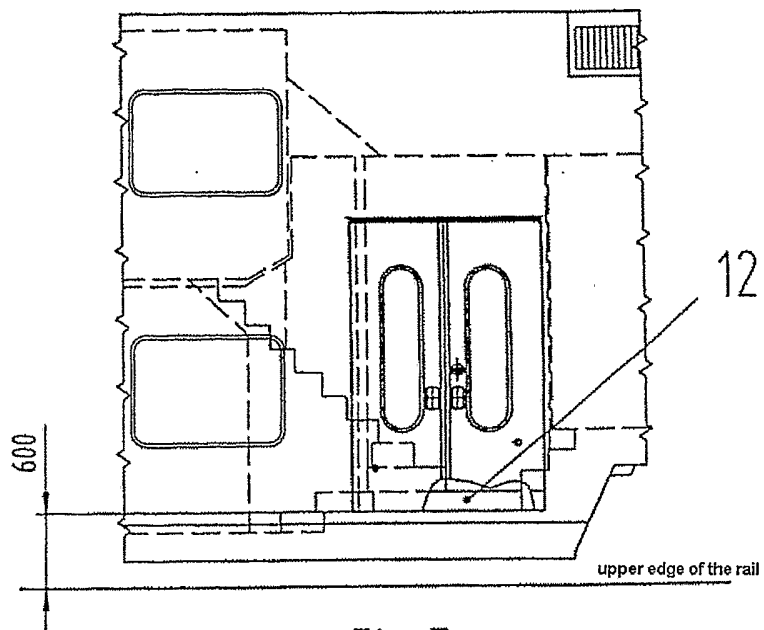


Fig.5

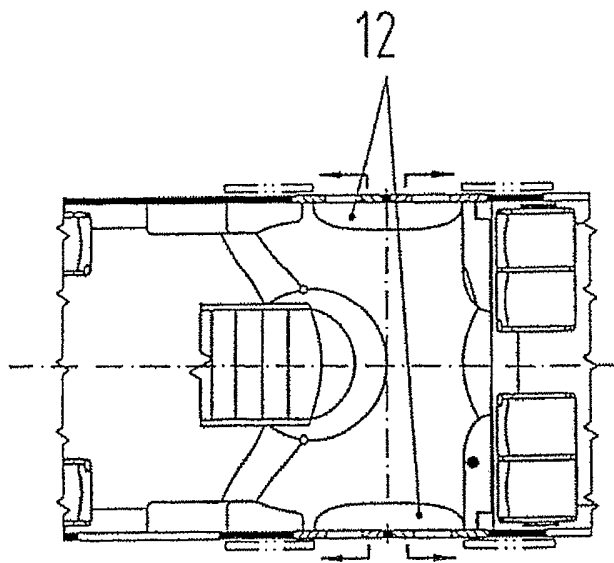


Fig.6

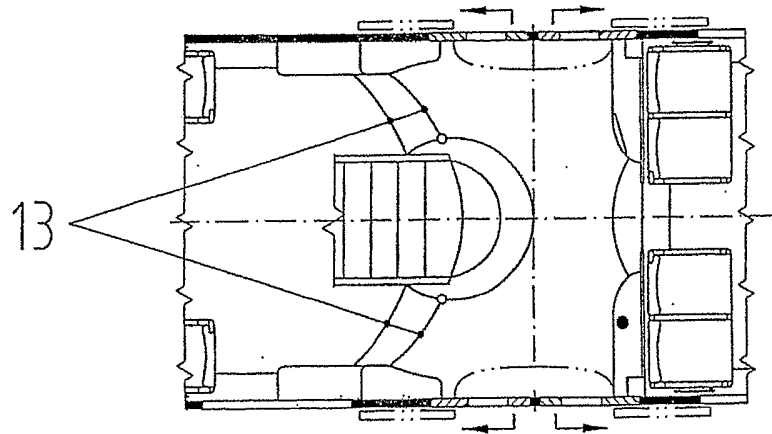


Fig.7

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 02/14245A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B62D31/04 B61D1/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B62D B61D B64C

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)

EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 270 892 A (WATSON HENRY ALWYN) 19 May 1927 (1927-05-19) figures 9,10 ---	1,4
A	DE 44 23 243 A (GOERLITZ WAGGONBAU GMBH) 11 January 1996 (1996-01-11) cited in the application abstract; figures ---	1,2,4,10
A	EP 0 760 321 A (GEC ALSTHOM TRANSPORT SA) 5 March 1997 (1997-03-05) abstract; figures ---	1,2,4,10
A	EP 0 625 457 A (INVENTIO AG) 23 November 1994 (1994-11-23) abstract; figures ---	1,2,4,10
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Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

° Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
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- *O* document referring to an oral disclosure, use, exhibition or other means
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- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- * & * document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 02/14245

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 233 617 A (HULSE OSCAR) 14 May 1925 (1925-05-14) figures -----	1, 3, 4, 7, 10

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Information on patent family members

International Application No

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