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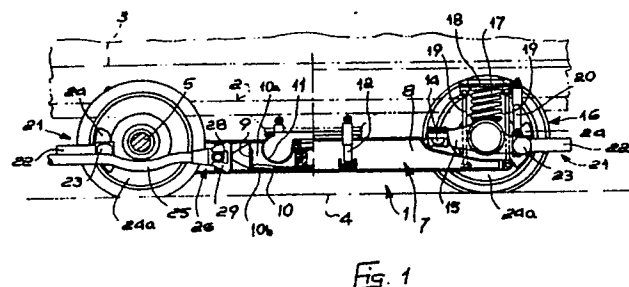
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(54) **Bogie for passenger railway carriages with the floor at platform level throughout the carriage.**

(57) A bogie for railway carriages for the transport of passengers which has a frame (7) on which the body of the carriage (3) rests through the intermediary of secondary means of suspension (11) suspend beneath two pairs of journal boxes (15) carrying wheelsets (16) respectively, with intermediate primary suspension members (17) in which the secondary means of suspension (11) are at least partially contained within the vertical dimensions of the frame (7) and the primary means of suspension (17) are included within the vertical dimensions of the wheels (24A) of the wheelsets, the bogie being capable of carrying a carriage body (3) with a floor (2) which has at least one portion in the part above the bogie at a level lower than the vertical dimension of the wheels (11), with provision for dismantlable braking means (21) and means (28) for controlling and limiting rolling movement by the body with respect to the bogie.



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BOGIE FOR PASSENGER RAILWAY CARRIAGES WITH THE FLOOR AT PLATFORM LEVEL THROUGHOUT THE CARRIAGE.

This invention relates to a bogie for railway carriages for the transport of passengers which makes it possible for the floor of the carriage to be placed at a low height above the plane of the rails, and in any event at a height lower than the maximum diameter of the wheels.

In pulled railway carriages which are designed for the carriage of passengers it is particularly important that travellers should be able to enter the carriage and move within it as quickly as possible in order to reduce stopping times at stations and to offer greater convenience to users.

With this object a suitable arrangement consists of constructing the floor of the carriage at the same level as the station platform so as to prevent the movement of passengers leaving and alighting from the carriage being slowed down by the need to negotiate one or more steps.

In order to achieve this station platforms could be raised to the level of the floor in existing carriages, but this is not possible because of the considerable difference in level which has to be filled in, which would make modification of the structure of all stations unacceptable, but platforms are currently being raised to an intermediate level standardised at 600 mm from the plane of the rails. This is not sufficient to bring the platform up to the level of the floor, which in conventional carriages is determined by the dimensions of the bogies beneath, the wheels of which cannot be of too small a diameter, and the frame of which together with the corresponding means of suspension are placed above the axles.

Carriages in which the floor is at a low level over a greater part of the carriage, corresponding to the new platforms abovementioned, are known, but there are several access steps to the end parts with a raised floor beneath which the bogies are mounted.

These carriages are however not satisfactory because of the existence of these internal steps which are a cause of danger when the carriage is in motion and which restrict freedom in the positioning of internal fittings.

There arises therefore the problem of constructing carriages which have a floor at the same level throughout their length, at the same level as the station platforms, or platforms modified for that purpose, which have for this purpose bogies whose frames and suspension members do not necessitate raising of the floor above them.

These objects are achieved by this invention which provides a bogie for railway carriages for the transport of passengers incorporating a frame on

which the body of the carriage rests with intermediate secondary suspension means suspended beneath two pairs of journal boxes carrying wheelsets respectively with intermediate primary means of suspension in which the secondary means of suspension are at least partially contained within the vertical dimensions of the frame and the primary means of suspension are contained within the vertical dimension of the wheels of the wheelsets, the bogie being capable of carrying the body of a carriage with a floor of which at least one portion in the part above the bogie is at a level below the vertical dimension of the wheels, with provision for removable braking means and means for controlling and limiting rolling movement of the body with respect to the bogie.

In greater detail the frame of the bogie consists of a pair of side members connected in the central area to a pair of parallel transverse beams some distance apart bounding at least one opening in the position of the centre of gravity of the frame itself within which are housed the secondary means of suspension attached to the frame of the bogie and to the body of the carriage and supporting the latter, with corresponding journal boxes supporting the wheelsets with corresponding primary means of suspension being also present at the ends of the side members.

Preferably the frame of the bogie is constructed of a pair of longitudinal side members connected in the central portion by means of a pair of parallel transverse beams some distance apart which in turn are connected together by means of a central cross-member bounding a pair of openings which are aligned transversely to the direction of motion of the bogie, within which are mounted the secondary means of suspension carrying the shell of the carriage.

The secondary suspension consists of one or more pneumatically damped springs fitted with corresponding shock absorbers.

The journal boxes bearing the wheelsets with the intervening members of the primary suspension each consist of a journal box arm connected by a hinge to the end of one of the side members above it and further connected to the side member by at least one tie rod with the primary means of suspension in between.

Above each journal box supporting one end of a wheelset there rest elastic means comprising the primary suspension at the top of which there is a cap which is in turn attached by means of a pair of tie bars to the ends of the side member on which the journal box is hinged, the side member in this

way bearing on the journal box, parallel to the elastic means, with a shock absorber member being also placed between the journal box and the cap.

The vertical dimension of the elastic means above the journal box and the cap resting above it does not exceed the maximum diameter of the wheel when new.

The dismantlable braking means consist of a jaw member for each journal box attached by detachable means of attachment to the journal box and enclosing the adjacent wheel, bearing a pair of cylinder and piston actuators each of which are provided with a corresponding wearing surface which can be tightened against corresponding braking discs attached to the opposite sides of the wheel.

The means for controlling and limiting rolling movement of the body with respect to the bogie consist of a transmission bar connecting the body of the carriage to the bogie, comprising an axially and torsionally rigid rod provided at its ends with elastic universal joints which are connected to the body and the bogie frame respectively, these joints comprising elastic means of connection with a high rigidity in the vertical plane transverse to the direction of movement of the carriage.

The elastic means of connection with a high rigidity in the vertical plane transverse to the direction of movement of the carriage consist of a bush placed between and attached to a fixed portion of the joint, integral with the frame of the bogie or the body of the carriage and a mobile portion attached to the rod bearing the joints at its ends, this bush consisting of a rubber ring or the like which is integral with a retaining ring and has greater flexural rigidity in a vertical plane transverse to the direction of movement of the carriage than its flexural rigidity in a vertical plane parallel to the direction of motion of the said carriage.

Further details may be obtained from the following description referring to the appended drawing, in which:

Figure 1 shows the bogie according to the invention in side view, and in cross-section along the plane of the line I-I in Figure 2,

Figure 2 shows the bogie in Figure 1 in plan view,

Figure 3 shows the bogie in Figure 1 in front view,

Figure 4 shows a detail of the universal attachment between the bogie and the horizontal bar connecting to the carriage in cross-section along the plane IV-IV in Figure 5,

Figure 5 shows a cross-section along the plane V-V in Figure 4,

Figure 6 shows the seating attachment of the universal joint to the frame of the bogie in front view,

Figure 7 shows a cross-section along plane VII-VII in Figure 6.

As Figures 1, 2 and 3 show, the bogie according to the invention, indicated as a whole by 1, has a structure whereby the floor 2 of the carriage 3 which its supports, showned by a dotted and dashed line, is kept at a particularly low level in comparison with the plane of the rails 4, virtually only the height of the structure bearing the load of the carriage above axle 5.

The maximum dimensions in the vertical direction due to the wheels, the diameter of which cannot be reduced beyond a limiting value, is shown on the raised side areas 6 of the shell, as illustrated in Figure 3, limited only to the dimensions of the wheels, where control valves, raised seats and the like may be located while the floor remains at a low level.

As shown in Figure 2 the bogie has a frame 7, conveniently of a sheet box structure, comprising two side members 8 which are parallel to the direction of movement of the carriage connected in their central area by two transverse beams 9 which together with a central cross-member 9a bound two symmetrical quadrangular openings 10a. Within these openings 10a are two corresponding cross-members 10, the ends of whose arms rest on corresponding supports 10b on side members 8, beams 9 and cross-member 9a.

Cross-members 10 have pneumatically damped springs 11 comprising the secondary suspension of the bogie on which the body of the carriage is supported.

These damped springs are mounted within openings 10a and their dimension in a vertical direction is substantially equal to or slightly greater than the thickness of the frame of the bogie itself, so that the surface of the body supported on the springs lies at a level slightly above the upper plane of frame 8.

Advantageously pneumatic springs 11 are fed from a single main which ensures that pressures between the springs are equalised and behave in a similar manner to a single spring placed in a central position on the frame.

Frame 7 is also attached to body 3 of the carriage by vertical shock absorbers 12 and horizontal shock absorbers 13 which control its movements.

Stop buffers, which are not illustrated, are also provided on the bogie frame and on the body in order to limit movement of the bogie with respect to the body in a transverse direction, to supplement the elastic restoration provided by the pneumatic

springs.

On the end of side members 8 are mounted universal supports 4 of an elastic rubber type for arm journal boxes 15 bearing wheelsets 16.

Spring 17 of the primary suspension rests on each journal box and is topped by a cap 18 which is connected by a pair of tie rods 19 to the end of one side member. The tie rods are connected to the cap and the journal box by spherical hinges which allow the cap and the spring on which it rests to follow all the movements dictated by the journal box.

A shock absorber 20 is also fitted between cap 18 and journal box 15.

With this structure the frame of the bogie is suspended below the journal boxes by tie rods 19, the dimension which this would have if placed above the plane of the axle being eliminated in this way.

Journal boxes 15 bear the brakes 21, each consisting of a jaw 22 enclosing a wheel and connected to the journal box, bearing a pair of opposing cylinders 23 and fitted with linings 24 which act on discs 24a located on either side of the wheel.

Cylinders 23 may be hydraulic, like those used in motor vehicles, or pneumatic, as already used in railways, of suitable size.

While the suspension is in motion the entire unit moves and remains below the plane of the axles, thus giving rise to no vertical dimension below the shell.

This structure also particularly assists maintenance and repair, because the entire brake jaw together with the hydraulic cylinders and the corresponding linings can be quickly dismantled from the journal box for inspection or repair and replaced by a new one without the carriage to which the bogie is fitted being obliged to be out of service for some time.

The frame of the bogie is connected to the shell in the longitudinal direction by a draw bar 25 which also has the effect of controlling rolling of the shell.

For this purpose bar 25 has joints 26 providing a connection to the shell and to the bogie as illustrated in the overall side view in Figure 1 and in greater detail in Figures 4 to 7.

As shown in these figures each joint 26 has a body 27 which is rigidly attached to bar 25 bearing horizontal axis rollers 28 inserted in corresponding forks 29 of a seat 30 which is integral with the bogie frame or the carriage shell.

Within body 27 there is a vertical axis pin 31 connected to body 27 by a rubber bush 32 provided with an outer metal retaining ring 32a. Pin 31 has profiled end portions 33 by which it is fixed in corresponding recesses 34 in seat 30, for example by means of bolts inserted in the corresponding

threaded holes 35, as illustrated by the dotted and dashed line in Figure 7.

Bush 32 has different degrees of stiffness for oscillations and displacements in the vertical plane containing the axis of bar 25 and in the vertical plane at right angles thereto, in particular less rigidity in the plane of the rod and greater rigidity in the plane transverse to the rod. In this way the longitudinal dynamic force on the shell induced by pitching movements of the bogie are appreciably reduced while the greater rigidity in the plane transverse to the bar conferred on the joint by rollers 28 inserted in forks 29 controls rolling movements between the shell and the bogie, impeded by the torsional resistance of bar 25. The torsional deformability of bush 32 allows the bogie to rotate when the carriage enters a curve.

The structure according to the invention thus makes it possible to provide a bogie whose frame does not get in the way between the axles and the lower plane of the shell, thus enabling the greater part of the latter to be placed at the lowest height above the axles compatible with the movement of the suspension, with only restricted parts of that plane being at a level higher than the diametral dimension of the wheels, with the primary suspension contained within the height of the wheels, thus offering the possibility of reducing the difference in level between the floor and station platforms to the point where it even no longer exists, without thereby reducing the structural strength of the bogie frame.

A plurality of variants may be introduced without thereby going beyond the scope of the general characteristics of the invention.

Claims

1) A bogie for railway carriages for the transport of passengers, characterised in that it has a frame on which the shell of the carriage rests with intervening secondary means of suspension, suspended beneath two pairs of journal boxes carrying corresponding wheelsets with intervening primary means of suspension, in which the secondary means of suspension are at least partly contained within the vertical dimension of the frame and the primary means of suspension are contained within the vertical dimension of the wheels in the wheelsets, the bogie being capable of carrying a carriage shell with a floor of which at least a part is at a level below the vertical dimension of the wheels in the part overlying the bogie, dismantlable braking means and means for controlling and restricting rolling movement of the shell with respect to the bogie being also fitted.

2) A bogie for railway carriages for the transport of passengers according to claim 1, characterised in that the frame of the bogie consists of a pair of longitudinal side members connected to the central part of a pair of parallel transverse beams some distance apart, bounding at least one aperture in the position of the centre of gravity of the said frame, within which are located secondary means of suspension attached to the frame of the bogie and to the shell of the carriage and supporting the latter, with corresponding journal boxes supporting the wheelsets being located at the end of the longitudinal members with corresponding means for the primary suspension.

3) A bogie for railway carriages for the transport of passengers according to claim 2, characterised in that the frame of the bogie consists of a pair of longitudinal side members connected in their central portion by a pair of transverse parallel beams some distance apart which are in turn connected together by a central cross-member, bounding a pair of openings aligned transversely to the direction of movement of the bogie, within which are mounted the secondary means of suspension supporting the shell of the carriage.

4) A bogie for railway carriages for the transport of passengers according to claim 2 or 3, characterised in that the secondary suspension consists of one or more pneumatic springs fitted with corresponding shock absorbers.

5) A bogie for railway carriages for the transport of passengers according to claim 2, characterised in that the journal boxes bearing the wheelsets with intervening means of primary suspension each consist of a journal box with an arm connected by means of a hinge to the end of one of the side members above it and further connected to the longitudinal member itself by means of a tie rod with intervening primary means of suspension.

6) A bogie for railway carriages for the transport of passengers according to claim 5, characterised in that above each journal box supporting one end of a wheelset there are mounted elastic means comprising the primary suspension at the top of which there is a cap which is in turn connected through a pair of tie rods to the end of the side member to which the journal box is hinged, the longitudinal member in this way bearing on the journal box parallel to the elastic means with a shock absorber device also placed between the journal box and the cap.

7) A bogie for railway carriages for the transport of passengers according to claim 6, characterised in that the dimension of the elastic means above the journal box and the cap supported above it in the vertical direction does not exceed the maximum diameter of the wheel when new.

8) A bogie for railway carriages for the transport of passengers according to claims 1 and 2, characterised in that the dismantlable braking means consist in the case of each journal box of a jaw member attached to the journal box by dismantlable means of attachment and enclosing the adjacent wheel bearing a pair of cylinder and piston actuators each provided with a lining which can be pressed against corresponding brake discs attached to the opposing faces of a wheel.

9) A bogie for railway carriages for the transport of passengers according to claim 1, characterised in that the means for controlling and limiting rolling movement of the shell with respect to the bogie consist of a draw bar connecting the shell of the carriage to the bogie, consisting of a bar which is axially and torsionally rigid and provided at the ends with elastic universal joints connected to the shell and the bogie frame respectively, these joints comprising elastic means of connection with great stiffness in the vertical plane transverse to the direction of movement of the carriage.

10) A bogie for railway carriages for the transport of passengers according to claim 9, characterised in that the elastic means of connection with high stiffness in the vertical plane transverse to the direction of movement of the carriage consist of a bush placed between and attached to a fixed portion of the joint, integral with the frame of the bogie or the shell of the carriage, and a movable portion attached to the bar carrying the joints at its ends, this bush consisting of a ring of rubber or the like integral with a retaining ring and being more flexurally rigid in a vertical plane transverse to the direction of movement of the carriage than in a vertical plane parallel to the direction of motion of the carriage.

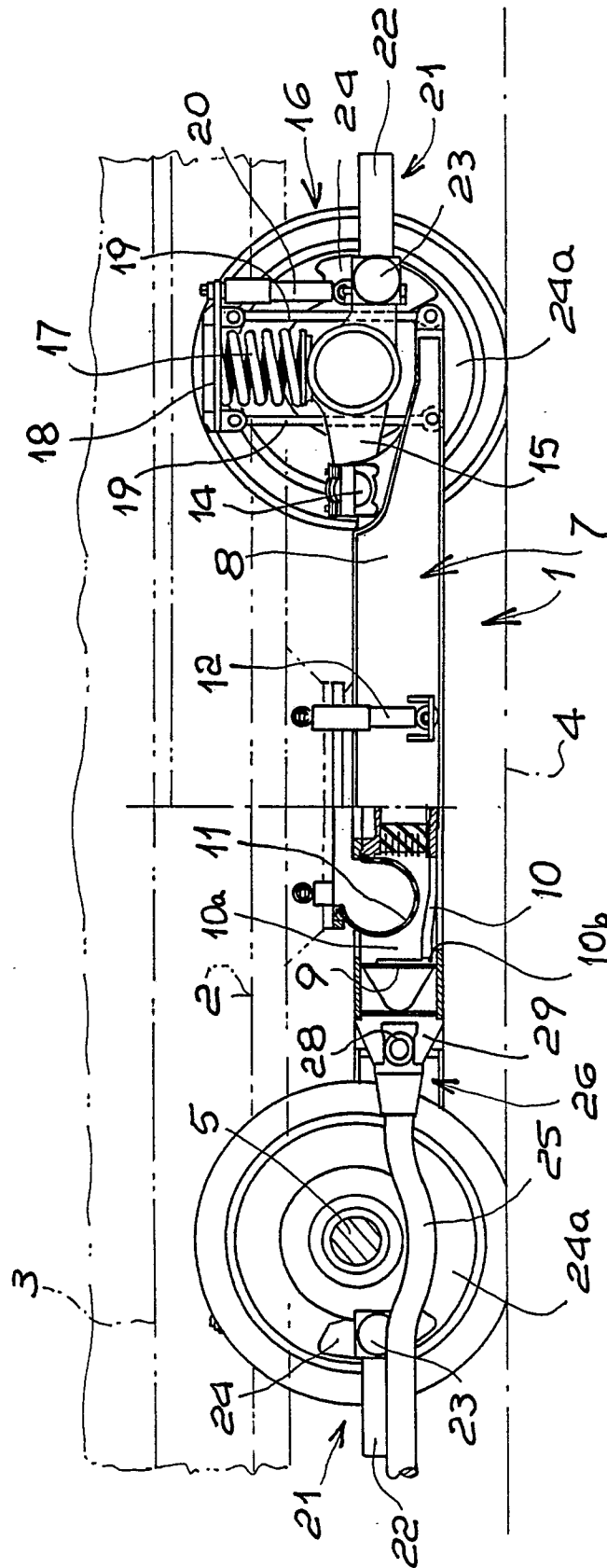


Fig. 1

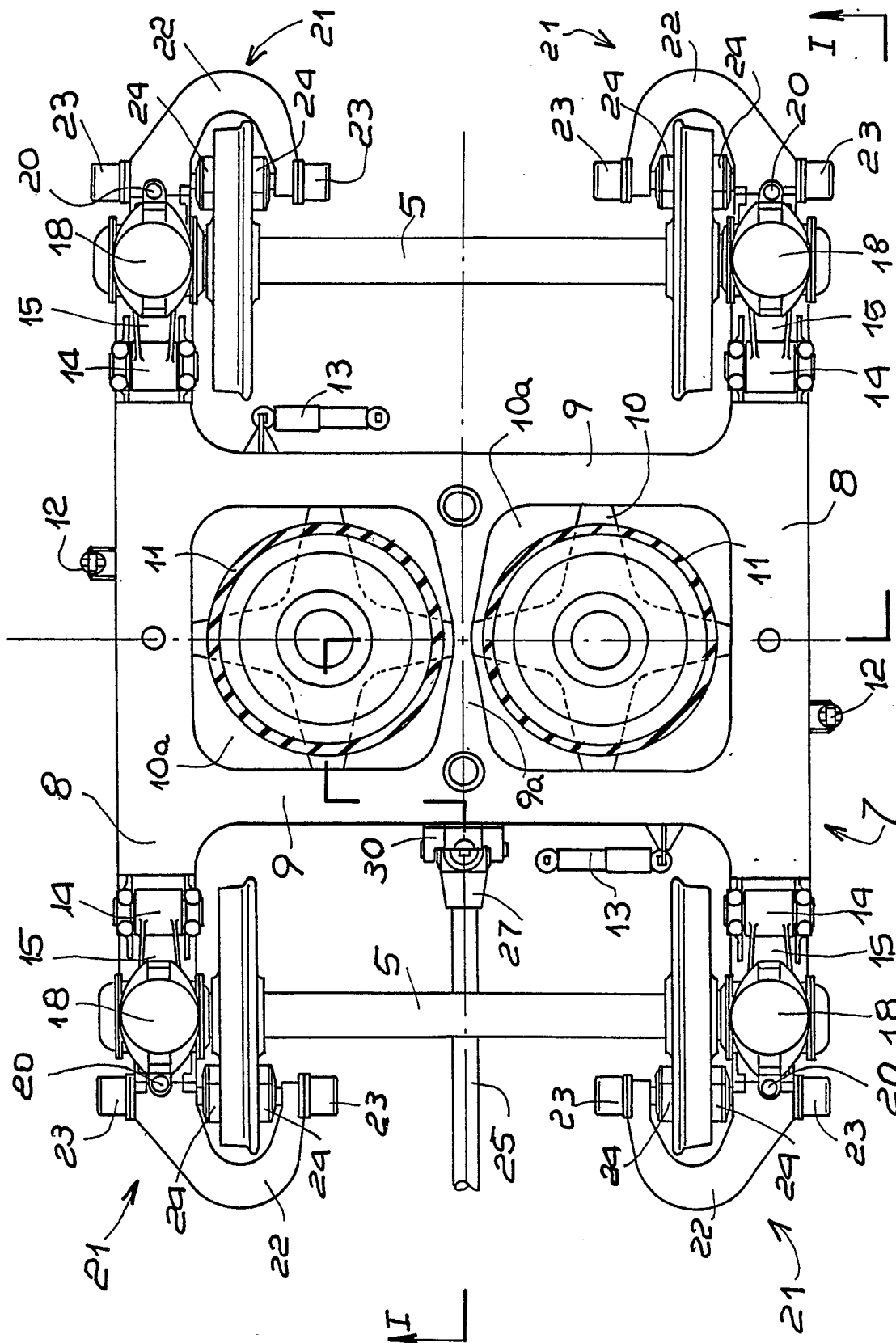
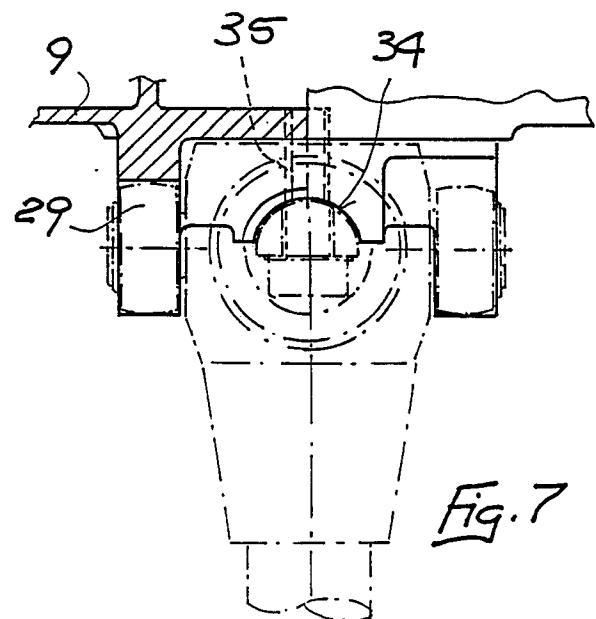
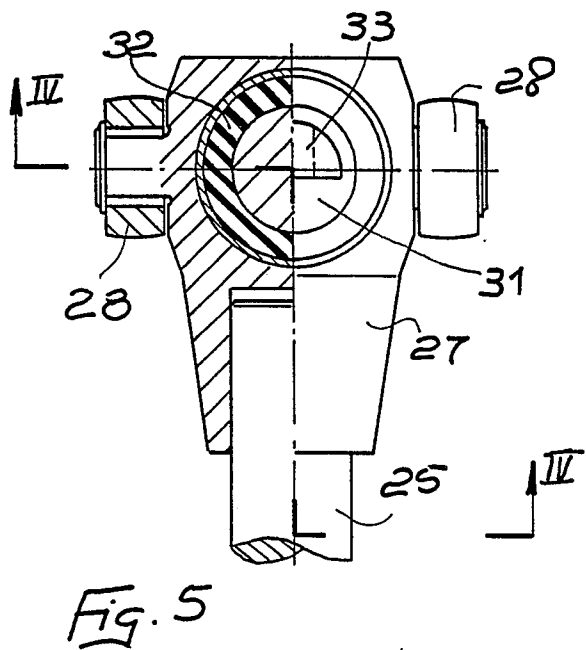
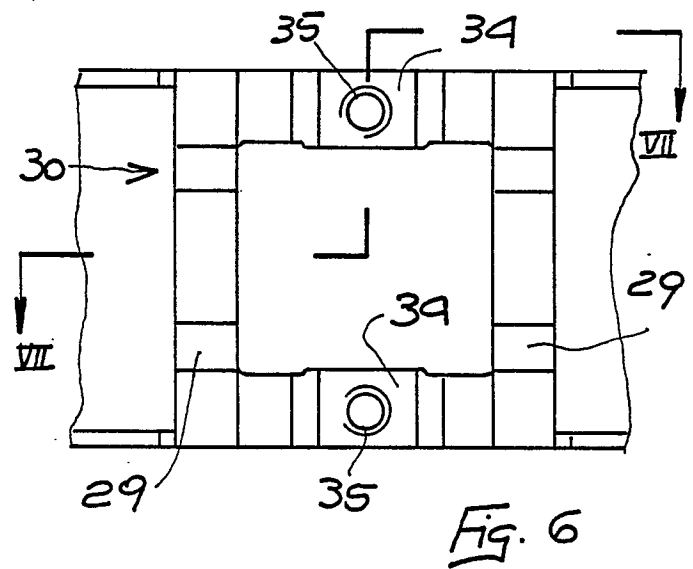
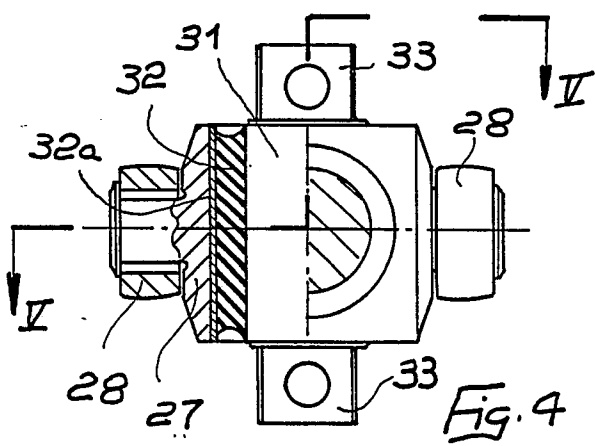
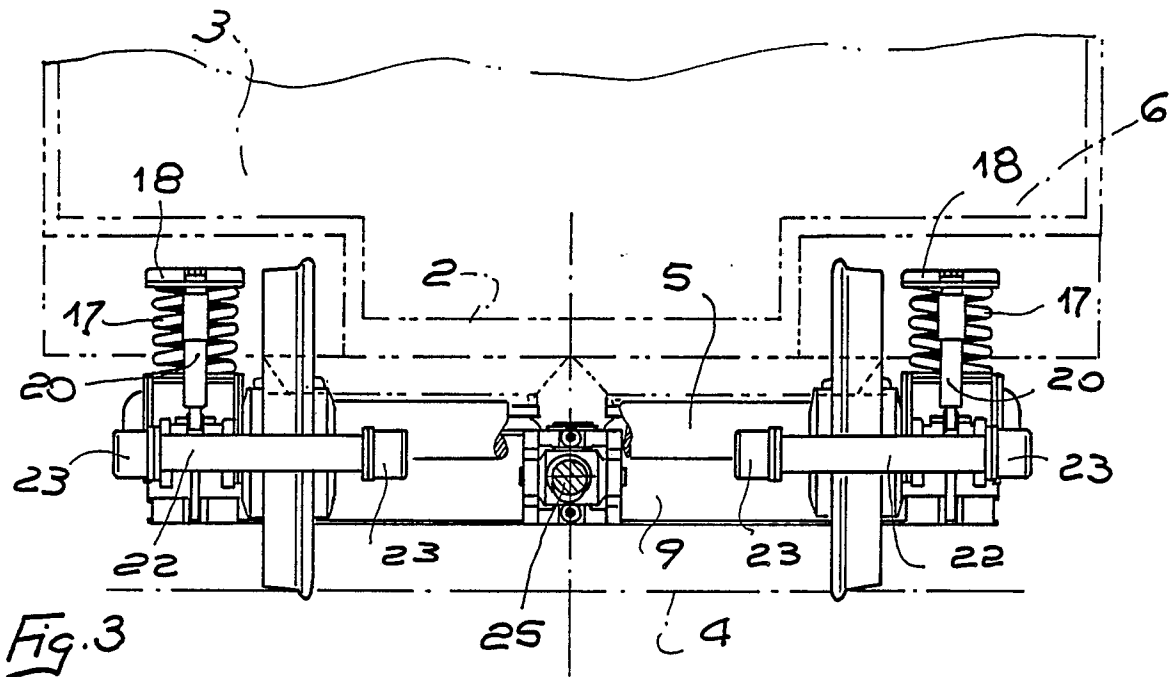


Fig. 2





EP 89 20 0597

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)
Y	EP-A-0 181 295 (FIAT FERROVIARIA SAVIGLIANO S.p.A.) * Figures 1-3; page 1, lines 7-15; page 3, line 2 - page 6, line 9 *	1	B 61 F 5/10 B 61 F 5/14 B 61 F 5/30
A	---	2-4	B 61 F 5/52 B 61 H 5/00
Y	EP-A-0 177 460 (FIAT FERROVIARIA SAVIGLIANO S.p.A.) * Figures 1-5; page 3, line 18 - page 6, line 16 *	1	
A	---	8,9	
A	EP-A-0 134 201 (FIAT FERROVIARIA SAVIGLIANO S.p.A.) * Figures 1-3; page 3, line 3 - page 5, line 15 *	1	
A	EP-A-0 183 619 (SCHNEIDER JEUMONT RAIL) * Figures 1,4-6; page 2, line 22 - page 4, line 6 *	1,8	
A	EP-A-0 046 619 (SAB INDUSTRI AB) * Figures 1,2; page 4, line 17 - page 6, line 2 *	1,8	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 21-06-1989	Examiner CHLOSTA P.
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	