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(71) Applicant (for all designated States except US): **SCT TECHNOLOGY, LLC** [US/US]; 1209 Orange Street, Wilmington, DE 19801 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **HEWITT, Paul** [GB/PT]; Rua Principal 56, Fanadia, Sao Gregoris, P-2500-064 Caldas Da Rainha (PT). **JAMIESON, Wayne** [GB/GB]; Alverton, Fisher Street, Methil, Fife KY8 3AH (GB).

(74) Agents: **DUNLOP, Brian, Kenneth, Charles** et al.; Wynne-Jones, Laine & James, 22 Rodney Road, Cheltenham, Glos. GL50 1JJ (GB).

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(54) Title: RAILWAY BOGIES

(57) Abstract: This invention relates to bogies for railway rolling stock. In particular it relates to suspension arrangements for such bogies wherein the frame is mounted on a spring suspension arrangement. In one embodiment the spring suspension arrangement comprises two groups of springs on either side of a wheel axle (11), each group comprising an inner spring (14) and two outer fore and aft springs (15, 16). In another arrangement there are two lower springs (14) on either side of a wheel axle (11) and at least one upper spring (21) above the axle. The arrangements described provide better lateral and longitudinal stiffness and shear characteristics which, reduce hunting and wheel wear. They also enable the axles to accommodate increased loads.



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Railway Bogies

The present invention relates to bogies for railway rolling stock, and particularly but not solely to bogies for railway freight wagons.

Railway bogies typically comprise a generally rectangular frame, arranged to be mounted via a bearing to the underside of the railway wagon chassis for turning about a central vertical axis, this bogie frame being mounted on a pair of wheelsets, each consisting of an axle having a wheel and a bearing fixed to it adjacent to each of its opposite ends. The wheelset is attached to the bogie frame via a saddle or axlebox assembly which encloses the bearing at each end of the wheelset. The saddle or axlebox has a number of coil suspension springs standing vertically. The bogie frame is provided with pedestal formations adjacent its four corners, the four pedestals being supported on the upper ends of the suspension springs of the four saddle or axlebox assemblies. This suspension arrangement is known as a primary suspension.

In current arrangements, the suspension springs are disposed at a common level, either above or below the level of the axle centreline, such that the suspension therefore has a single plane of spring interaction and the springs can both shear and bend. In some other suspensions, the springs are arranged purely to bend in their axial planes. In considering the response of a helical coil spring to a lateral force, the deflection due to the bending moment and the deflection produced by the shearing force both have to be taken into account. In the case of a free helical spring supported flat at each end, the lateral force response can be considered equal at the 0,90,180 and 270 degree directions. The lateral spring rate varies with the seating conditions of the spring ends and with their rocking behaviour.

We have now devised bogies which exhibit improved performance in response to forces to which, in use, the suspension springs are subjected, such that the bogie exhibits improved self-steering and more easily absorbs lateral forces.

In accordance with the present invention, there is provided a railway bogie which comprises a bogie frame supported on each wheelset axle end by a

suspension arrangement the springs of which exhibit a first overall response to forces laterally of the bogie and a second, different response to forces longitudinally of the bogie.

5 In one embodiment, the springs of each suspension arrangement exhibit a first overall stiffness against forces laterally of the bogie, and a second, lower, overall stiffness against forces longitudinally of the bogie: the springs thus exhibit less deflection laterally than longitudinally. As a result, the bogie wheelset exhibits good resistance to lateral movement or hunting on straight track, and moves more readily longitudinally on curved track, so exhibiting
10 improved self-steering. As a consequence, wheel wear is reduced.

In one embodiment, each suspension arrangement comprises two inner springs, one either side of the wheelset axle, and two outer springs each side of the axle, further from the axle than the inner springs. Preferably the inner spring and two outer springs, each side of the axle, are arranged as a group in a
15 triangle. Preferably each of the inner springs has twice the axial stiffness of each of the outer springs of the same group, so that the axial stiffness of the inner spring is matched by the combined axial stiffnesses of the two outer springs. Preferably the bogie frame rests on the tops of the inner springs via respective friction wedges, which give the bogie a floating control property,
20 providing vertical and lateral friction damping, thus permitting and damping longitudinal or yaw motion of the wheelset.

In a second embodiment, each suspension arrangement comprises two lower springs, one either side of the wheelset axle, and at least one upper spring disposed above the wheelset axle. In this arrangement, the overall stiffness
25 against forces laterally of the bogie is relatively high. The bogie frame preferably rests on the tops of the lower springs via respective friction wedges. Preferably the upper springs are constrained, over part of their lengths, such that pure shear will take place in the lateral plane.

It is preferred that the suspension arrangements of either the first or
30 second embodiments of the invention include a proportional load valve (PLV) to measure apparent load on an axle.

It is envisaged that the proportional load valve is fitted in vertical alignment with an axle, preferably substantially above a suspension spring fitted to a suspension frame or is arranged to measure the load applied directly through the axle e.g. by being connected to a point in the plane passing through the vertical centreline of the axle by a one to one lever.

Preferably, the proportional load valve sends a pneumatic signal to a brake control valve which controls the force applied to brake blocks acting on the wheels.

Conventional railway bogie friction wedges have their inclined contact surfaces cambered or convex-curved from end-to-end, but these surfaces are straight across the width of the wedge. Preferably, the inclined contact surface of each friction wedge is cambered or convex-curved both longitudinally and transversely, providing a generally domed surface and therefore a reduction in the contact area and an increase in mean maximum pressure thereby reducing resistance to longitudinal movement of the wheelset: this leads to a further improvement in the self-steering performance of the bogie.

Also in accordance with the present invention, there is provided a friction wedge for a railway bogie suspension, the inclined contact surface of the wedge exhibiting convex curvature both longitudinally and transversely.

In a further embodiment of the invention there is provided a welded connection between parts of a bogie frame. It is envisaged that the welded connection between a bolster and side frame is provided by a full penetration butt weld.

Embodiments of the present invention will now be described by way of examples only and with reference to the accompanying drawings, in which:

Figure 1 is a side view of the suspension arrangement at one corner of a first embodiment of self-steering railway bogie in accordance with the present invention;

Figure 2 is a plan view of the arrangement shown in Figure 1;

Figure 3 is a view, similar to Figure 1, of the suspension arrangement of a second embodiment of self-steering railway bogie in accordance with the present invention;

5 Figure 4 is a side view of the suspension arrangement at one corner of a modified second embodiment of self-steering railway bogie in accordance with the present invention;

Figure 5 is a side view of one of the friction wedges used in the suspension arrangements of the bogies shown in Figures 1 to 3;

10 Figure 6 is a section through the friction wedge, on the line V-V shown in Figure 4;

Figure 7A shows a conventional weld joint between an existing bolster and side frame of a bogie; and

Figure 7B shows a weld joint used in embodiments of the current invention where a full penetration butt weld is used.

15 Referring firstly to Figures 1 and 2 of the drawings, a self-steering bogie comprises two wheelsets, one wheel of one such wheelset being shown at 10. A saddle or axlebox assembly is mounted to the end of the axle of the wheelset via a bearing 11 and a bearing adapter 12, the saddle 13a or axlebox assembly 13b, (see Figure 3) collectively referred to as 13 which provides flat seats, to
20 either side of the axle, for respective sets of coiled suspension springs. Each set of suspension springs comprises three such springs, namely a first or inner spring 14, adjacent the axle, and then second and third or outer springs 15,16 which are disposed side-by-side, parallel to the axle, further from the axle than the first spring 14 and symmetrically to either side of that spring. The bases of
25 the suspension springs are all below the axle centreline and may be all on the same level as each other, or slightly offset: for example, in the embodiment shown, the bases of the inner springs 14 are at a slightly higher level than the bases of the outer springs 15,16. The inner springs 14 support respective friction wedges 17, the upper surfaces of which are inclined downwardly away from the axle. The bogie further comprises a generally rectangular frame 19,
30 arranged to be mounted via a bearing to the underside of the wagon chassis for

turning about a central vertical axis in conventional manner: the bogie frame is provided with a pedestal formation 20 adjacent each of its four corners. The pedestal 20 is supported directly on the upper ends of the suspension springs 15,16 and indirectly, via the friction wedges 17, on the upper ends of the suspension springs 14.

It will be appreciated that bogie suspension uses a floating control wedge principle, the arrangement of the friction wedges providing vertical and lateral friction damping and permitting and damping longitudinal or yaw motion of the respective wheelset. The inner springs 14 have twice the axial stiffness of each of the outer springs 15,16, throughout the spring travel: thus the stiffness of the single inner spring 14 is matched by the combined stiffness of the two outer springs 15, 16, in each triangular group or nest of three: as a result, the damping factor provided by the friction wedges is maintained at the required level. It will be appreciated that the centre of resistive movement of each triangular group of springs is displaced to the centre of the triangle and this effectively increases the overall lateral stiffness: in particular, the overall lateral stiffness of each triangular group of springs is greater than the combined lateral stiffnesses of the individual springs of the group, whilst the overall longitudinal stiffness of the group is less than the combined lateral stiffness of the individual springs of the group. Lateral vehicle generated forces are accordingly resisted, by shear and bending of the groups of springs, to a greater degree than longitudinal track-generated (traction and creepage) forces. Consequently, each wheelset of the bogie is more resistant to lateral movement or hunting on straight track, and more ready to move longitudinally on curved track, giving good self-steering properties. As a further consequence, wheel wear is reduced.

Figure 3 shows the suspension arrangement of a second embodiment of bogie in accordance with the present invention and parts thereof which correspond to parts of the bogie shown in Figures 1 and 2 are denoted by the same reference numerals. The suspension arrangement shown in Figure 3 differs from that shown in Figures 1 and 2 by comprising different springs respectively above and below the axle centreline, which increases control of the lateral and longitudinal movements of the wheelset and hence the dynamic

performance of the bogie. In particular, the suspension comprises two springs 21 which have their bases seated flat on the saddle or axlebox 13 above the axle, and two springs 14, one either side of the axle, which have their bases seated flat on the saddle or axlebox 13 below the axle centreline: all four
5 springs 14,21 are aligned in the same longitudinal plane. The respective pedestal 20 of the bogie frame is supported directly on the upper ends of the springs 21 and indirectly, via friction wedges 17, on the tops of the springs 14. In a modification, the two upper springs 21 may be replaced by a single such spring. In either case, the upper spring, or upper springs overall, have a higher
10 lateral spring rate than the lower springs.

It will be appreciated that by disposing the springs 21 almost directly over the axle, the bogie frame can accommodate a much greater load, for a particular spring of given dimension and rate, than they could in the conventional arrangement where such springs sit outside the inner wedge supporting springs.
15 This is important, because the trend is towards a requirement to support greater loads per axle than before.

It will also be observed that the distance between the axis of the axle and the centres of the springs 21 and 14 respectively are different. Consequently the different moments of the springs results in different longitudinal stiffness
20 resulting from the springs. A similar effect is achieved in Figure 1 by having the basis of the springs 15, 16 lower than those of springs 14, as previously mentioned.

In Figure 3 a proportional load valve (PLV) 18 measures the apparent load on an axle and sends a pneumatic signal to the brake control valve which in
25 turn controls the force, in response to the measured pressure, applied to the brake blocks which act on the wheels to slow the wagon. When the wagon is unloaded, for example, this prevents 'over braking' and hence reduces the likelihood of flats being formed on the wheel.

The signal from the PLV 18 is generated by the compressive load applied
30 to the coil suspension springs 13, 14, 15 located in the saddle or axlebox assembly. The PLV is located on the top of one of the coil suspension springs. This can lead to margins of error in recording the load acting on the axle.

Normally each bogie has a PLV. The load acting on a bogie is half the total mass of the wagon. A bogie has two axles therefore each axle sees one quarter of the total mass of the wagon. This is where the margin of error can arise. If the PLV is located on top of one of the suspension springs it actually
5 sees either a quarter of the load acting on the axle, in the case of Y25 bogie i.e. one spring either side of the saddle or axle box or on eighth of the load acting on the axle in the case of an Axle Motion Bogie i.e. two springs either side of the saddle or axle box. The error can arise because it is possible for the springs to be compressed in an unequal manner i.e. one side of the saddle or axle box
10 could be compressed more than the other because of track deformities etc.

In a preferred arrangement the PLV to be fitted immediately above the axle when one spring is located above the centreline of the axle therefore to measure directly one quarter of the load acting on the axle or it can be fitted on the bogie frame *and* actuated by a 1:1 ratio lever 18a, which responds to the
15 load applied to the axle on its vertical centreline. If two springs are used directly above the axle a 1:0.5 ratio lever activated by both springs simultaneously measures on quarter of the axle load. The novel approach of direct load sensing over the axle eliminates the margin of error associated with *traditional* load sensing from the side of the saddle or axlebox.

20 The floating control arrangement of the friction wedges again provides vertical and lateral friction damping and permits and dampens longitudinal or yaw motion of the respective wheelset. Lateral forces are resisted by the upper springs in a double shear plane, such that the bending component of spring flexure is at a minimum. The overall lateral spring rate is relatively high such
25 that the wheelset is better able to resist rail-to-wheel lateral forces and, in particular, any tendency for hunting on straight track. When subjected to longitudinal forces, the upper and lower springs deflect readily due to the combined action of bending moment and shear on two planes spaced about the axle centreline: the upper springs deflect, overall, at a lower rate than the lower
30 springs, due to the axle forces on the saddle or axlebox causing rotation; the effect is a lowering of the overall spring rate, producing easier longitudinal wheelset steering. In either condition of lateral or longitudinal loading or forces,

the response of the suspension to vertical loads is unchanged, as the vertical spring rates are equal for all springs.

The bases of the springs rest flat and planar on their supports and, on the upper springs, they are constrained over part of their lengths such that pure shear will take place in the lateral planes. As has been previously mentioned, the lateral load portion on the upper spring plane is greater than on the lower spring plane, due to a larger bending couple from the top of the upper spring seat to the axle centreline. There is a larger load at the bases of the upper springs due to the larger bending couple, as the saddle or axlebox is caused to move in a level and co-planar manner under the action of lateral loads. However, bending is restricted and the overall lateral spring rate is increased because of the predominant shearing action, giving greater stability of the wheelset particularly when running in tare on straight track. Under longitudinal forces, the spring seats are still flat and planar but their ends are not constrained: the upper springs have a larger bending moment, for the reasons previously explained. In addition, the saddle or axlebox is caused to rotate slightly when displaced longitudinally and a more pure bending of the upper springs results: this is because the upper springs are closer to the vertical centroid of the axle longitudinal motion than the outer, lower springs, which are also under wedge action as a result of the longitudinal displacement. Both the upper and lower springs deflect by bending and in some part shear, with the upper springs taking a larger proportion of the forces and purely bending. The overall lateral spring rate in the longitudinal direction is reduced, leading to relatively easier steering, with the longitudinal forces arising from wheel-to-rail friction on curves, leading to effective self-steering.

Figures 4 and 5 show one of the friction wedges used in the suspensions of the two embodiments of bogie which have been described. Conventional friction wedges are cambered along the inclined support surface 30 of the wedge, as shown in Figure 4, but this surface is straight across the width of the wedge. In accordance with the present invention, the inclined surface 30 is cambered both along the inclined surface 30 of the wedge, and is also cambered across the width of the wedge, as shown in Figure 5. The surface is

thus convex-curved in both its longitudinal and transverse directions, providing a generally domed or spherical contact surface: there is therefore a reduction in the frictional contact area and an increase in the mean maximum pressure and thereby a reduction in the resistance of the wheelset to longitudinal movement and a more ready accommodation of saddle or axlebox rotation in the horizontal plane. These factors lead to a further improvement in the self-steering performance of the bogie.

The bogie frame accommodates various bogie equipment and in general is fabricated by welding together two side beams, one beam or bolster into an H shaped frame. Conventionally, the welded connection between an existing bolster and a side frame is achieved by fillet welding as shown in Figure 7A. Side frame 40 is welded to bolster 41 by fillet welds 42. By using fillet welds 42, the allowable stress level permitted on the joint between side frame and bolster is governed by the classification of a fillet weld (fillet welds are low classification welds). However with applicants arrangement as shown in Figure 7B there is the ability to increase the level of weld classification by using a butt weld, such as a full (or complete) penetration butt weld which gives an increase in the allowable stress. This is achieved by forming part of the inner wall of the frame 40 integrally on the bolster so that the welds 43 are moved outwardly to form butt welds. Further by cutting away the outer walls from 40 further butt welds can be formed at 44. The applicants construction also moves the welded connection into a lower stress region. The combination of improved weld classification and position thereby provides a more structurally efficient design. A further improvement is shown in Figure 8 where the bolster side frame interface is constructed to form an I-beam with the side frame; the web of the I-beam being located in the plane of the bogie journals.

Thus the bolster 45 is formed with an annular flange 46 that can be disposed within a generally circular aperture 47 of a wall of the side frame 40. The edges of the aperture 47 and the flange 46 are pointed so that they leave appropriate spaces for a circular double sided full pen weld 49.

The strength/weight advantages of I-beams are well known and this novel approach to the interface between the bolster and the side frame takes full

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advantage of them. Once again it also places the weld in a low stress position and enables a high classification weld to be formed.

The invention is intended to cover not only individual embodiments but also, combinations of the embodiments herein defined.

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Claims

1. A railway bogie including an elongate bogie frame supported on a plurality of wheelset axles by respective suspension arrangements, each arrangement including a plurality of springs which exhibit a first overall response to forces laterally of the bogie and a second different response to forces longitudinally of the bogie.
2. A bogie as claimed in claim 1 wherein each suspension arrangement exhibits a first overall stiffness against forces laterally of the bogie and a second, lower, overall stiffness against forces longitudinally of the bogie.
3. A bogie as claimed in claim 1 or claim 2 wherein each suspension arrangement includes a group of springs on either side of its axle, each group comprising an inner spring adjacent the axle and a pair of fore and aft outer springs.
4. A bogie as claimed in claim 3 wherein the springs in a group are arranged in a triangle.
5. A bogie as claimed in claim 3 or claim 4 wherein the inner spring in a group has twice the axial stiffness of each of the outer springs.
6. A bogie as claimed in claim 5 wherein the bogie frame rests on the top of the inner springs via respective friction wedges.
7. A bogie as claimed in claim 1 or claim 2 wherein each suspension arrangement includes two lower springs one either side of its wheel axle and at least one upper spring disposed above the wheel axle.
8. A bogie as claimed in claim 7 wherein the distance from the centreline of the axle to the centre of the base of the at least one upper spring is less than the distance from the centreline of the axle to the centre of the base of each lower spring.
9. A bogie as claimed in claim 8 wherein the bogie frame rests on the top of the lower springs via respective friction wedges.
10. A bogie as claimed in claim 6 or claim 15 wherein the surface of the friction wedge that supports the frame is cambered or convex curved both longitudinal and laterally.

11. A bogie as claimed in any one of the preceding claims wherein at least one of the springs is received in a pocket or pockets to reduce its effective length in shear.

5 12. A bogie as claimed in any one of the preceding claims including a proportional load valve (PLV) for producing an output signal indicative of the load applied to the axle in its vertical centre plane.

10 13. A railway bogie including a frame supported on a plurality of wheel set axles each having a vertical centre plane and a proportional load valve for producing an output signal indication of the load applied to the axle in its vertical centre plane.

14. A bogie as claimed in claim 12 or claim 13 wherein the PLV is offset from the centre plane and connected thereto by a 1:1 lever.

15 15. A friction wedge for a railway bogie suspension having an inclined contact or support surface which is convex curved or cambered both longitudinally and laterally.

16. A railway bogie frame including a side frame member and a cross member or bolster wherein the contact or contacts between the bolster and the side frame are butt contacts and the bolster and side frame are connected by a full penetration butt weld.

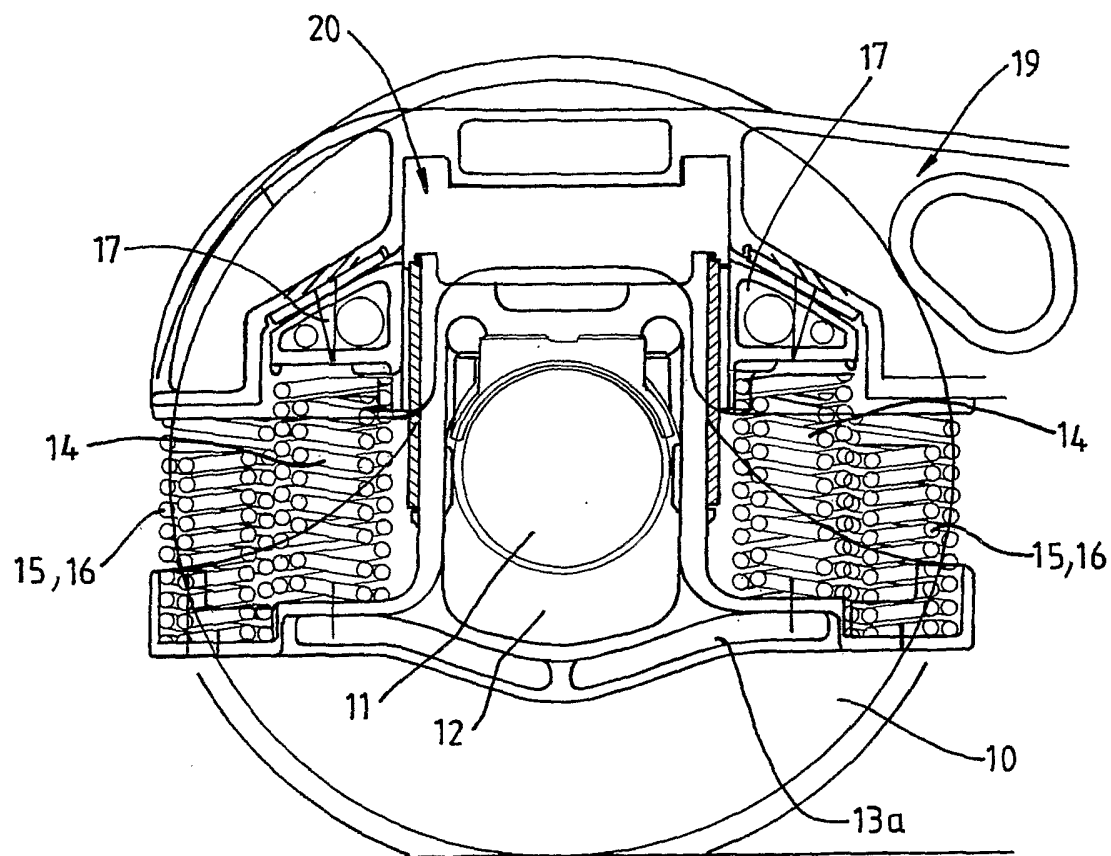
20 17. A frame as claimed in claim 16 wherein the bolster has an annular flange and the side frame has an aperture for receiving the flange.

18. A frame as claimed in claim 17 wherein the flange forms part of an I-beam.

25 19. A frame as claimed in claim 18 wherein the bolster and side frame are connected by a single generally circular weld.

20. A railway bogie as claimed in any one of claims 1 to 14 having a frame as claimed in any one of claims 16 to 20.

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*Fig. 1*

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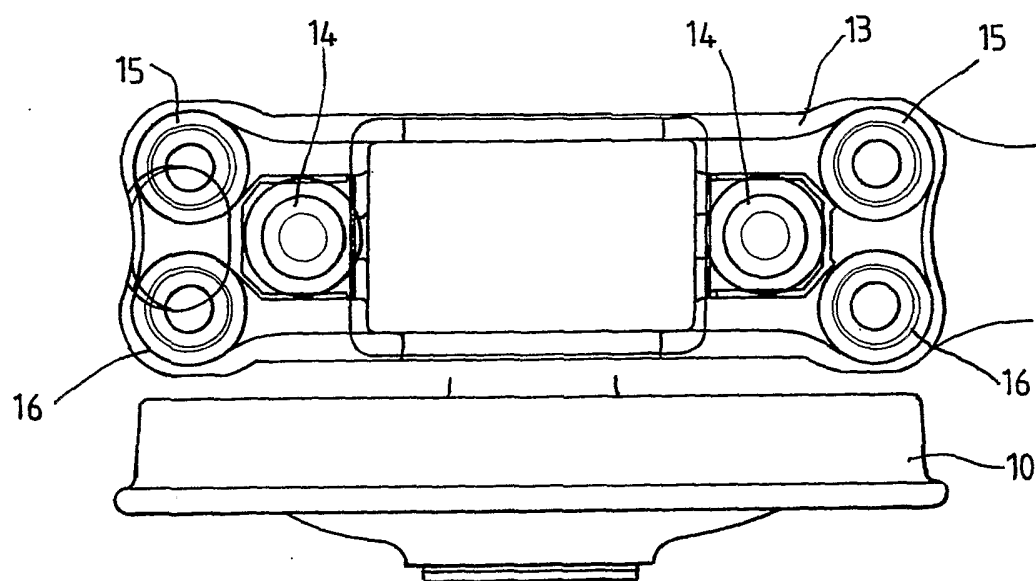


Fig. 2

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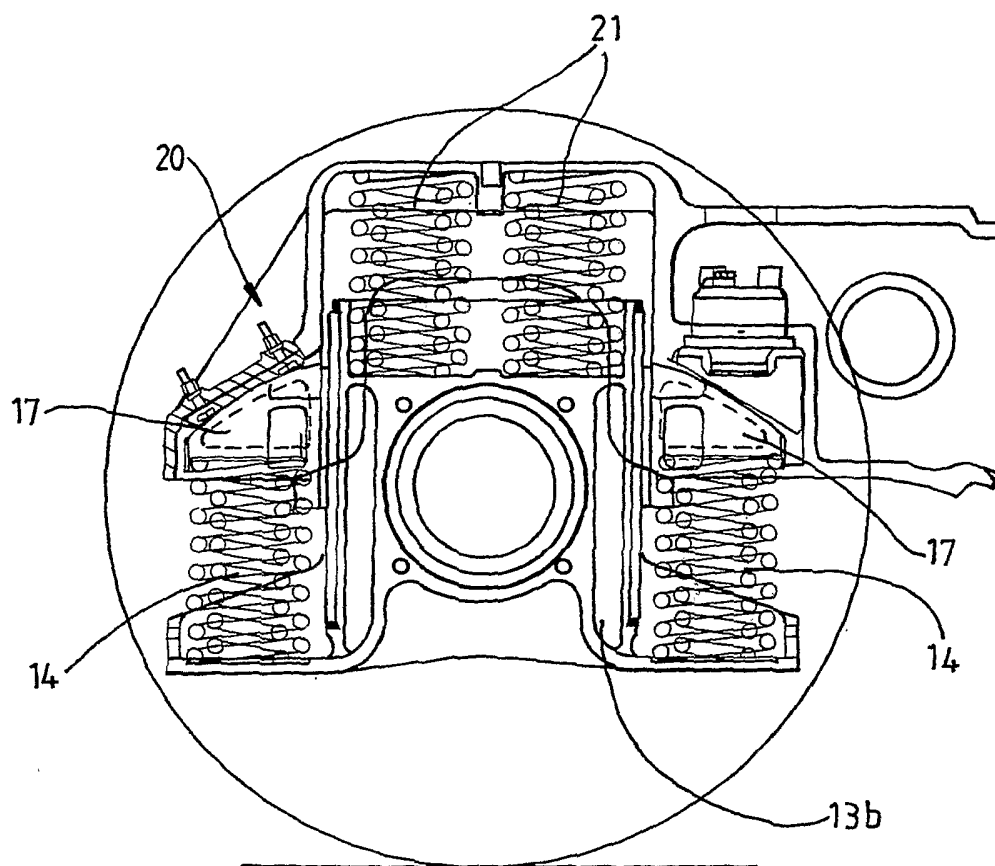
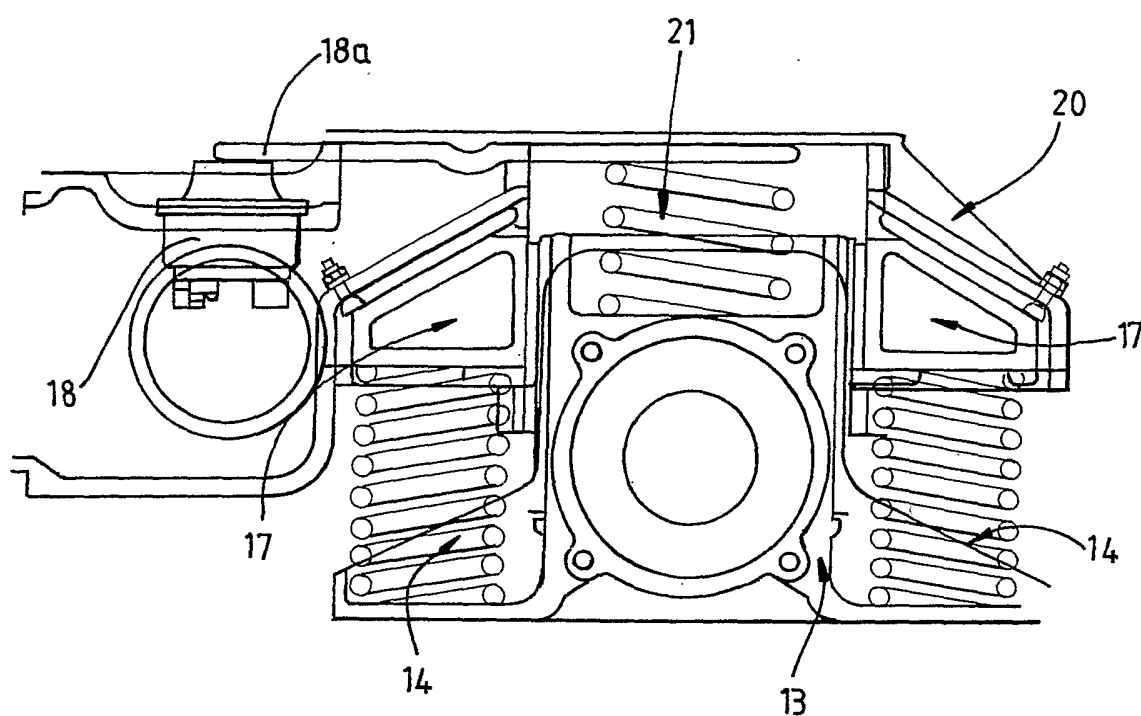


Fig. 3

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***Fig. 4***

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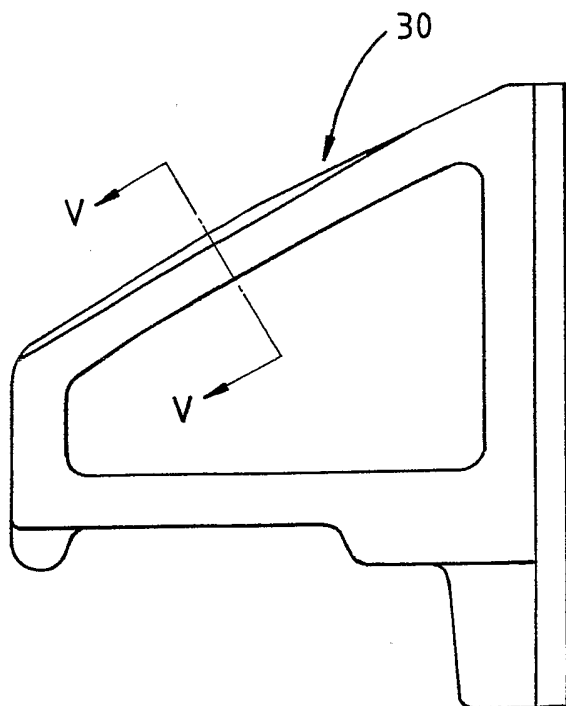


Fig. 5

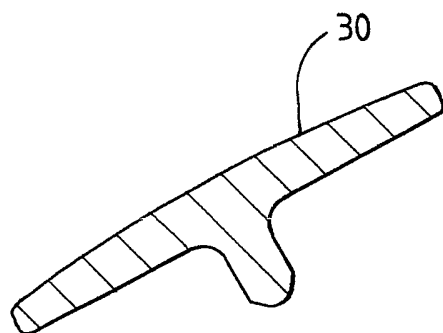
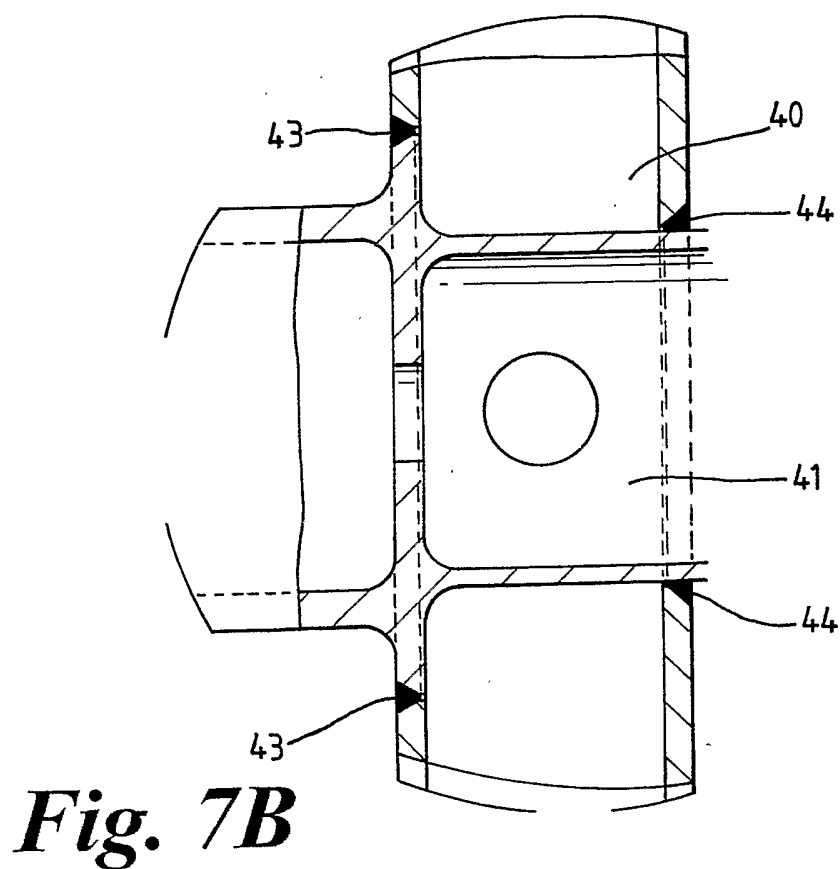
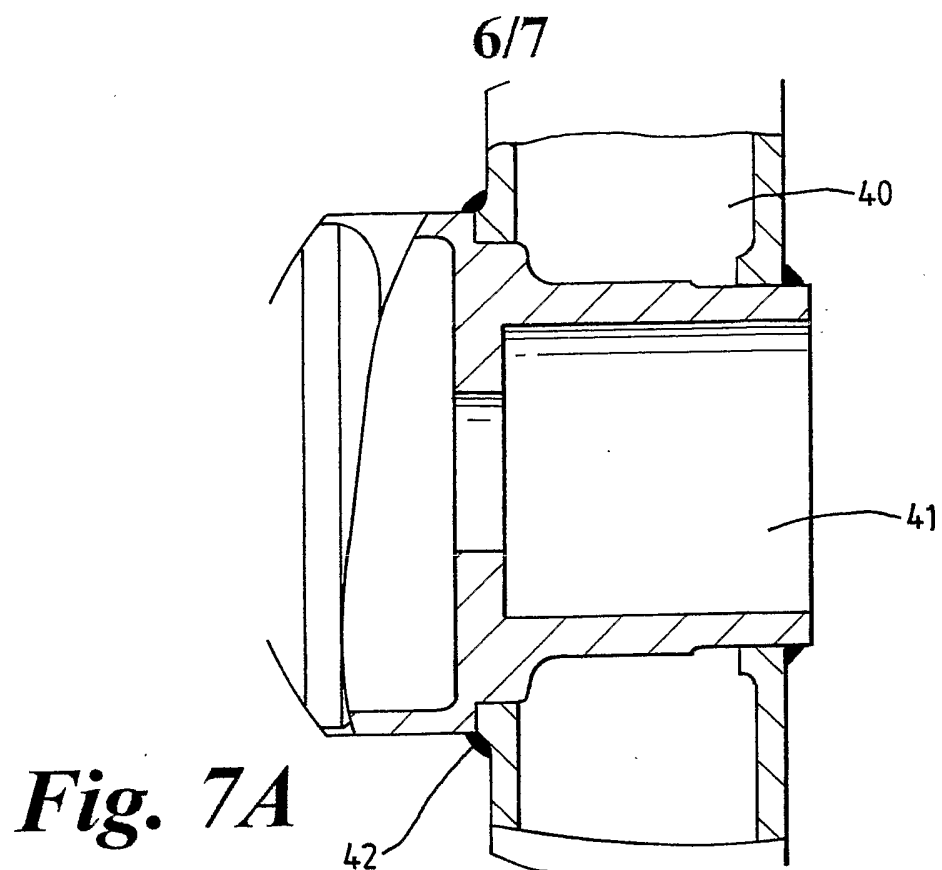


Fig. 6



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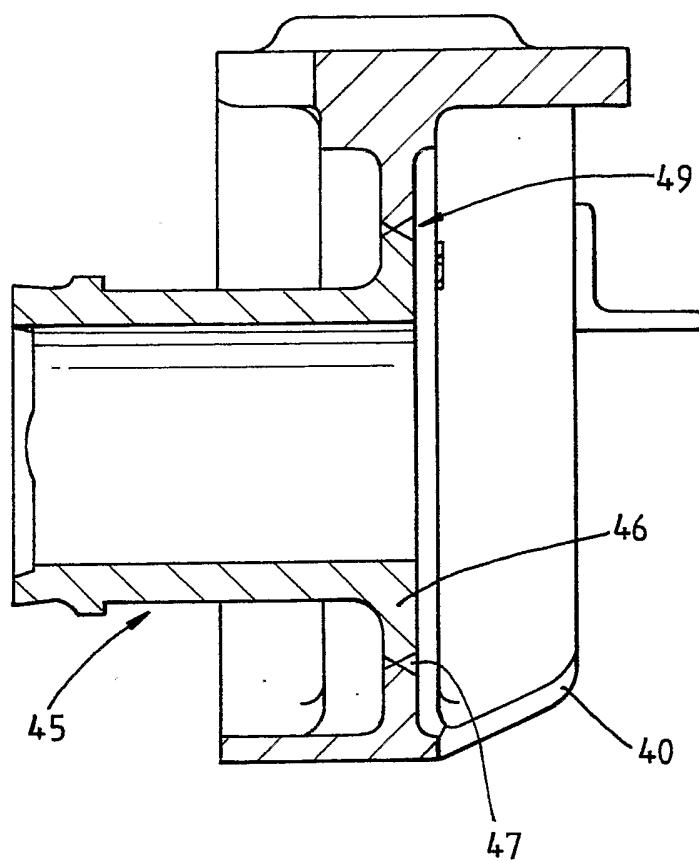


Fig. 8

INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2006/000052

A. CLASSIFICATION OF SUBJECT MATTER
INV. B61F5/30 B61F5/52

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)
B61F G01G

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, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 932 330 A (HERRING, JR. ET AL) 12 June 1990 (1990-06-12) column 2, line 37 - column 3, line 35; figures 3,4	1-4,7
A	-----	8
X	US 5 611 284 A (SMITH ET AL) 18 March 1997 (1997-03-18) column 5, line 37 - column 8, line 5; figures 1-4	1-4,7
A	-----	8
A	US 5 239 932 A (WEBER ET AL) 31 August 1993 (1993-08-31) column 2, line 50 - column 3, line 14; figure 2	6,9,10, 15
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☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2006/000052

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 443 953 A (USINES ET ACIERIES DE SAMBRE ET MEUSE SOCIETE ANONYME; SAMBRE ET MEUSE) 28 August 1991 (1991-08-28) column 4, line 11 - column 5, line 20; figures 1,2	13
A	-----	12
Y	US 2004/251058 A1 (CARR GARY A ET AL) 16 December 2004 (2004-12-16) paragraph [0030] - paragraph [0038]; figures 1-4	13
A	-----	14
A	US 5 522 468 A (DOHRMANN ET AL) 4 June 1996 (1996-06-04) column 3, line 27 - column 5, line 42; figures 1-4	14
A	-----	15
A	US 5 176 083 A (BULLOCK ET AL) 5 January 1993 (1993-01-05) column 2, line 54 - column 3, line 17; figures 1,2	15
X	-----	16,17, 19,20
X	US 3 915 095 A (BRIGGS ET AL) 28 October 1975 (1975-10-28) column 2, line 1 - line 37; figures 1-3	16,17, 19,20
X	-----	16,17, 19,20
X	US 4 133 268 A (GUILLAUMIN ET AL) 9 January 1979 (1979-01-09) column 2, line 61 - column 3, line 8; figures 1,2	16,17, 19,20
A	-----	18
A	GB 2 078 646 A (BRITISH STEEL CORP) 13 January 1982 (1982-01-13) page 1, line 96 - line 121; figures 5-7	18

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2006/000052

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-12

A railway bogie including suspension arrangements with a plurality of springs.

2. claims: 13,14

A railway bogie with a load valve.

3. claim: 15

A friction wedge for a suspension.

4. claims: 16-20

A railway bogie frame with a welded frame.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2006/000052

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4932330	A	12-06-1990	NONE	
US 5611284	A	18-03-1997	NONE	
US 5239932	A	31-08-1993	NONE	
EP 0443953	A	28-08-1991	AT 111042 T DE 69103784 D1 DE 69103784 T2 ES 2062704 T3 FR 2658471 A1	15-09-1994 13-10-1994 04-05-1995 16-12-1994 23-08-1991
US 2004251058	A1	16-12-2004	NONE	
US 5522468	A	04-06-1996	NONE	
US 5176083	A	05-01-1993	AU 641590 B2 AU 1506092 A CA 2066881 A1	23-09-1993 29-10-1992 24-10-1992
US 3915095	A	28-10-1975	AR 202483 A1 AU 473679 B2 AU 7039274 A BE 816738 A1 CA 1018824 A1 DE 2429547 A1 ES 427533 A1 FR 2234168 A1 GB 1439655 A IT 1014353 B SE 389069 B SE 7408183 A ZA 7403977 A	13-06-1975 01-07-1976 08-01-1976 16-10-1974 11-10-1977 16-01-1975 01-12-1976 17-01-1975 16-06-1976 20-04-1977 25-10-1976 23-12-1974 25-06-1975
US 4133268	A	09-01-1979	AT 350624 B AT 131976 A BE 838457 A1 CA 1058966 A1 CH 609624 A5 DE 2607346 A1 FR 2302225 A1 GB 1509112 A IT 1057231 B LU 74407 A1 NL 7601666 A ZA 7601042 A	11-06-1979 15-11-1978 28-05-1976 24-07-1979 15-03-1979 09-09-1976 24-09-1976 26-04-1978 10-03-1982 13-08-1976 27-08-1976 27-04-1977
GB 2078646	A	13-01-1982	NONE	