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(54) **Suspension system of railway vehicles**

(57) The invention provides a design solution for a suspension system of a railway vehicle, especially four-wheel freight car, that assures the system functioning at possibly low rolling resistance; at the same time this is solution assures that wheel sets can be correctly aligned in relation to tracks and stabilized, owing to which increased rolling resistance and wear-and-tear of both the wheel sets and rails is reduced. The objective has been achieved in such a way that in order to reduce friction resistance, rollers (9), preferably up to two of them, were incorporated in friction wedges (6) on a sloped surface, while other surfaces were provided with friction lining

pads (7) and (8). Working surfaces of the wedge (13), also mating surfaces of the base plate (1) and saddle column (5) were provided with friction pads (7) of a material having low friction factor, below 0.2. For better stabilization of the suspension system, the crosswise rigidity of spring sets (2) was enhanced, and rigidity of conventional spring sets was increased by dividing the springs with a plate (10) at half height. Further increase of the spring system rigidity was achieved by connecting the dividing plates (10) from adjoining spring sets (2) to each other, and joining the matching connected plates (10) on both sides of a car by use of stabilizing rods (12).

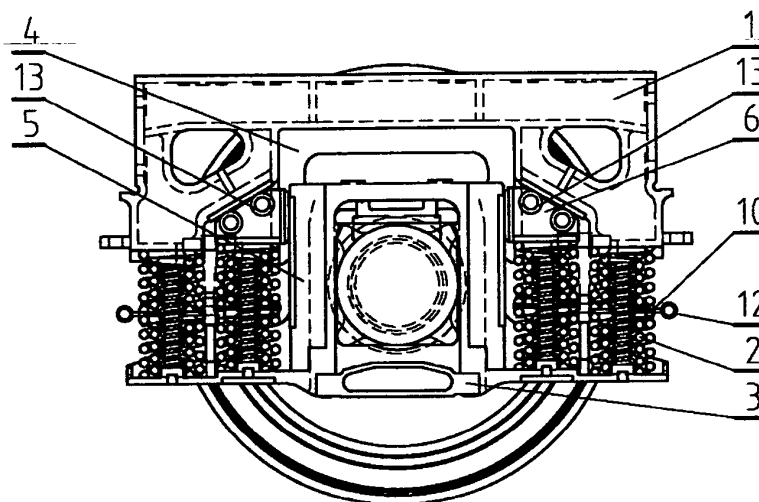


Fig. 1.

Description

[0001] Field of technology. The object of the present invention is a suspension system of railway vehicles, especially four-wheel freight cars, consisting of a set of springs, a saddle and friction wedges.

[0002] State of knowledge. Suspension systems known so far are designed in such a way that a chassis frame at both ends, and on both sides of a car is provided with base plates, where each of them is supported by a set of suspension springs mounted on a matching saddle. The saddle in turn, is seated on a bearing shell of a wheel set. In the central part of each base plate there is a space surrounded by surfaces that are mating with saddle columns. Between the saddle columns and the mating surfaces of base plates on both sides of the column, there are friction wedges supported by sets of saddle-seated springs. Usually a friction wedge is of a triangular shape, with different inclination of planes, and mating surfaces of the wedge, saddle and base plate are lined with pads. Resistance to sliding motion of the friction wedge relative to the base plate and saddle, which results in damping the motion, is induced by friction forces occurring between the wedge and the saddle column. With such combination of technical means, under certain weather conditions, while maybe having selected wrong materials (too high friction factor value), designed mating parts to improperly shape, or if the springs that stabilize the suspension system functioning are of insufficient rigidity, especially in crosswise direction, then different forces may occur and disturb the damping action of the wedges on motion of a car. Such disadvantageous changes may lead to jamming which in turn may result in a wrong position of a wheel set on a straight or curved track as well. As the consequence, rolling resistance increases, and wheel sets as well as rails become increasingly damaged.

[0003] Essence of the invention. The object of the present invention is to develop such a design of friction wedges that a low value of friction factor between the inclined wedge surface and mating base plate could be assured. As such solutions make operation of the car suspension system unstable when running straight, thus the rigidity of spring sets both lengthwise and crosswise of the car, needs increasing while keeping its vertical characteristics and dimensions unchanged. Neither the base nor the saddle need design modifications.

[0004] This problem has been solved so that in the first version of the invention the wedge surface formed by rollers, preferably up to two of them, is inclined. In case of two-roller wedge the surface formed by the rollers is inclined at an angle of 35° to the level, and the vertical surface forms a sector of a cylinder aligned with a horizontal axis. The vertical surface of a one-roller wedge is lined with material having a friction factor lower than 0.2, and the wedge next to the roller is provided with a bumper, in order to hinder its rotation. Springs of enhanced crosswise rigidity have been used. By dividing the springs,

preferably into two parts, with a dividing plate, the rigidity of springs in use till that time was modified. Dividing plates belonging to adjoining springs that support a base plate and a wedge, are mutually connected, and also the dividing plates located on one side of a car are connected with the matching dividing plates that are located on the other side of the car. According to the second version of my invention, the wedge plane is inclined to the level at an angle of $10^\circ \div 40^\circ$, preferably at 30° , and at the same time its vertical plane is inclined towards the wedge slope at an angle of up to 5° , preferably 3° . The plane of the base plate that is mating the inclined wedge plane, and the saddle column plane, are both lined with a material having the friction factor lower than 0.2. Springs of enhanced crosswise rigidity have been used. By dividing the springs, preferably into two parts, with a dividing plate, the rigidity of springs in use till that time was modified. Dividing plates belonging to adjoining springs that support a base plate and a wedge, are mutually connected, and also the dividing plates located on one side of a car are connected with the matching dividing plates that are located on the other side of the car.

[0005] Explanation of pictures. The object of the invention has been presented as an exemplary design in the following figures. Fig. 1 - Suspension system, version 1, two-roller wedge solution; Fig. 2 - Suspension system, version 1, one-roller wedge solution; Fig. 3 - Suspension system, version 2, non-roller wedge solution; Fig. 4 - second version design, two-roller wedge solution; and Fig. 5 - second version design, one-roller wedge solution.

Example of a design according to the invention, version 1.

[0006] A suspension system consists of base plates **1** fixed to a chassis frame at both ends of a car in the area where wheel sets are located; the base plates are supported by sets of suspension springs **2** mounted on matching saddles **3**. The saddle **3** is seated on a bearing shell (axle box) of a wheel set. In the central part of each base plate **1** there is a space **4** surrounded by surfaces that are mating with saddle columns **5**. Between the saddle columns **5** and the mating surfaces of base plates **1**, on both sides, friction wedges **6** are applied. Rollers, preferably one or two of them, are incorporated in the friction wedges **6**. In the two-roller friction wedge **6**, the surface formed by rollers is inclined at an angle of 30° to the level, and a lining pad **7** of a friction factor lower than 0.2 is applied over the vertical surface of the wedge. On the outside this vertical surface forms a sector of a cylinder aligned with a horizontal axis. In the one-roller friction wedge **6** the vertical surface is inclined towards the wedge slope at an angle of 3° , and a lining pad **8** of a friction factor lower than 0.2 is applied over the surface. A bumper **9** is mounted on the sloped plane next to the roller, on the lower side. A plate **10** divides spring sets **2**, preferably at half height. The plates **10** belonging to each of the two adjoining spring sets **2** are mutually con-

nected. The matching connected plates 7 on both sides of a car are connected through a stabilizing rod 11.

[0007] Example of a design according to the invention, version 2. A suspension system consists of base plates 1 fixed to a chassis frame at both ends of a car in the area where wheel sets are located; the base plates are supported by sets of suspension springs 2 mounted on matching saddles 3. The saddle 3 is seated on a bearing shell (axle box) of a wheel set. In the central part of each base plate 1 there is a space 4 surrounded by surfaces that are mating with columns 5 of the saddle 3. Between the saddle columns 5 and the mating surfaces of base plates 1, on both sides, friction wedges 10 are applied. The top surface of the friction wedge 10 is inclined to the level at an angle of 10° to 40°, preferably 30°, and its vertical surface is inclined towards the wedge slope at an angle of 3°. Lining pads 11 of a friction factor lower than 0.2 are applied over the base plate that is mating the inclined surface of the wedge 10, and over the surface of the column 5 of the saddle 3. Spring sets 2 are divided by the plate 10, preferably at half height. The plates 10 belonging to each of the two adjoining spring sets 2 are mutually connected. The matching connected plates 10 on both sides of a car are connected through a stabilizing rod 12.

[0008] Such combination of technical means assures that so designed suspension system will function properly.

Claims

1. A suspension system of a railway vehicle, especially four-wheel freight car, consisting of a base plate, saddle, friction wedges, spring sets, **characterized in that** a friction wedge (6) has a sloped surface formed by rollers (13) incorporated therein, preferably up to two of them, and at the same time, both the friction wedge (6) and the base plate (1) are supported by spring sets (2).
2. A suspension system of a railway vehicle, especially four-wheel freight car, consisting of a base plate, saddle, friction wedges, spring sets, **characterized in that** the top surface of the friction wedge (6) is inclined to the level at an angle of 10° to 40°, preferably 30°, and the inclined surface as well as the vertical surface are provided with friction lining pads (11) of a material having a friction factor lower than 0.2, and both the wedge (6) and base plate (1) are supported by spring sets (2) that are seated on a saddle (5).
3. A suspension system according to claim 1 or 2, **characterized in that** spring sets (2) are divided by a dividing plate (10) into parts, preferably into two parts, and at the same time the plates (10) belonging to adjoining spring sets (3) are mutually connected,

and the matching connected plates (10) on both sides of a car are connected to each other through a stabilizing rod (12).

4. A suspension system according to claim 2, **characterized in that** the outside surface of a friction lining pad (11) over the vertical surface of the friction wedge (6) is shaped in form of a sector of a cylinder aligned with a horizontal axis.
5. A suspension system according to claim 1 or 2, **characterized in that** there is a hole (16) in a panel (4), aligned with an axis of a spring set (2), and the inner spring (15) is left undivided.
6. A suspension system according to claim 1, **characterized in that** a one-roller friction wedge (6) is provided with a bumper (17) next to the roller (9) at the end of the friction wedge (6).
7. A suspension system according to claim 1, **characterized in that** in a two-roller friction wedge (6) the surface formed by rollers is inclined at an angle of 10° ÷ 40°, preferably 35°, to the level.

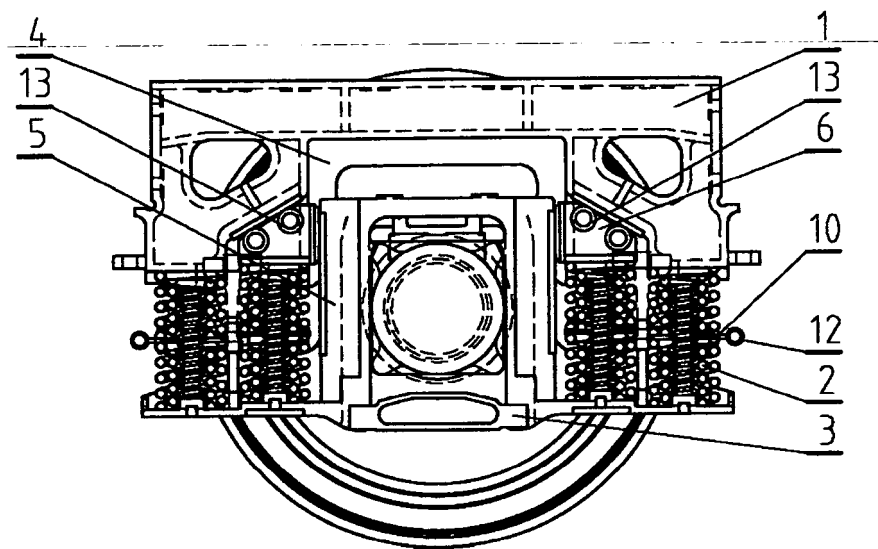


Fig. 1.

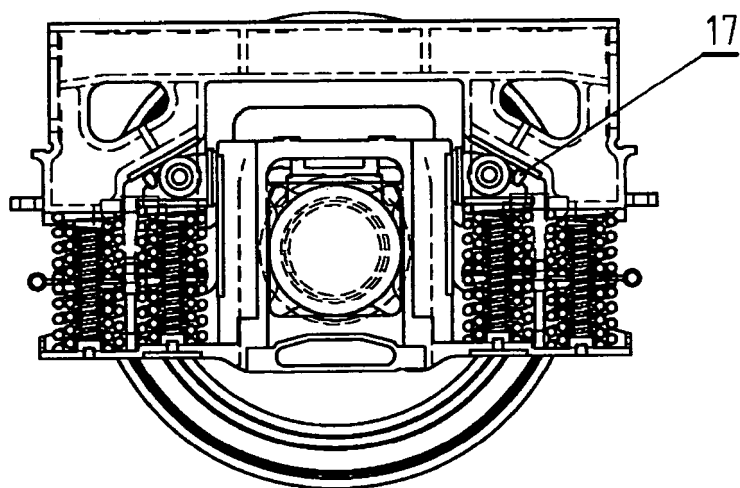


Fig. 2.

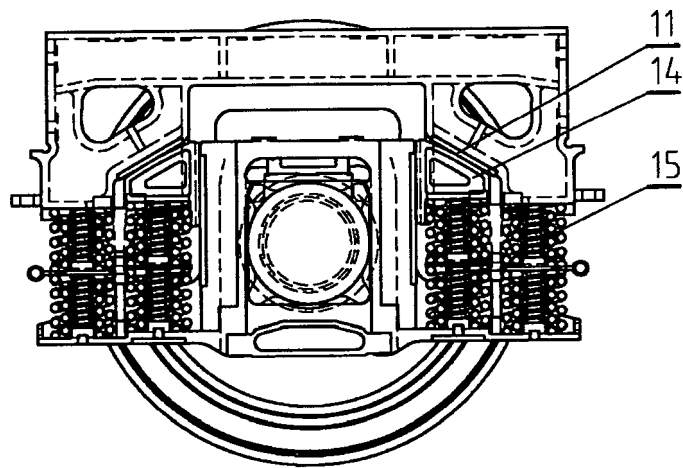


Fig. 3.

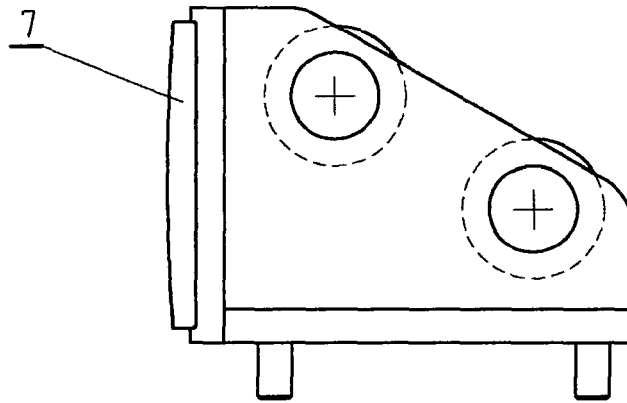


Fig. 4.

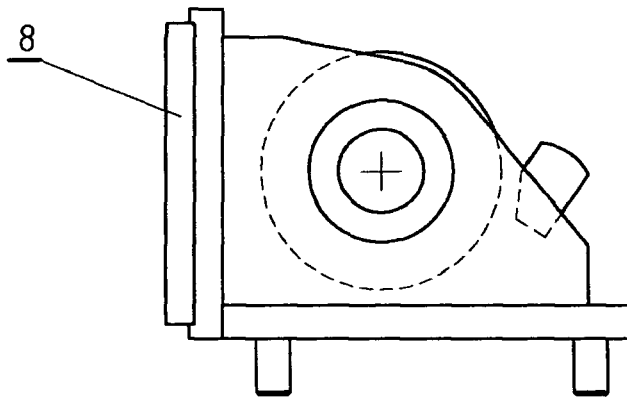


Fig. 5.



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2005/022689 A1 (FORBES JAMES W [CA] ET AL) 3 February 2005 (2005-02-03) * paragraph [0208] - paragraph [0213] * * figures 1a,1e,1d,6a *	2	INV. B61F5/32
A		1	
Y		3-5	
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Y	US 5 176 083 A (BULLOCK ROBERT L [US]) 5 January 1993 (1993-01-05) * column 3, line 1 - line 28 * * figures 1,2 *	4	
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A	US 2 731 923 A (GLENN F. COUCH) 24 January 1956 (1956-01-24) * figures 1,3 *	1-7	TECHNICAL FIELDS SEARCHED (IPC) B61F
A	US 4 915 031 A (WIEBE DONALD [US]) 10 April 1990 (1990-04-10) * abstract * * claims 25,32 * * figures 13-18 *	1-7	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 28 March 2007	Examiner Awad, Philippe
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			

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 EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 06 46 0038

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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