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(54) SUSPENSION FOR A RAIL VEHICLE

AUFHÄNGUNG FÜR EIN SCHIENENFAHRZEUG

SUSPENSION POUR UN VÉHICULE FERROVIAIRE

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DE-A1- 4 204 783 US-A- 3 977 332

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Description

[0001] This invention relates to a suspension for a rail vehicle.

[0002] Such a suspension is disclosed by DE 42 04 783 or US 3 977 332.

[0003] It is known in suspensions for rail vehicles for the main body of the vehicle to be suspended on a multi-axle bogie or a single axle bogie using suspensions which include a top pedestal supported by suspension springs which are in turn supported by an axle box attached to a wheel set by a bearing. Typically, as in the Barber Easy Ride Suspension, these include multiple long travel springs and have so called floating wedge friction damping. In this arrangement the friction damping is brought about by a fixed plate transmitting load to an inclined face of the wedge such that the vertical face of the wedge, having a composite liner, is forced against a respective vertical face of the axle box or saddle, on either side of the wheel/bearing centre line. This action results in a horizontal damping force acting towards the centre line, which produces resistive forces against lateral and vertical acceleration of the wheel set in the Y and Z planes respectively due to the frictional engagement of the vertical faces. This damping force is load dependent, increasing with increasing load on the vertical wedge support springs from tare to laden. In known arrangements the damping ratio, which is the ratio of the horizontal force at the wedge vertical face to the vertical force applied by the spring to the wedge, is fixed and constant.

[0004] Under current arrangements instability can occur during high speed tare running of rail vehicles. This is particularly true for freight vehicles, which tend to be either run in their tare or fully laden states.

[0005] The present invention consists in a suspension for a rail vehicle including at least one spring carrying a wedge constrained to move in the vertical direction and a load application member for engaging the wedge to transmit load to the wedge along a direction characterised in that the ratio of the horizontal force at the wedge vertical face to the vertical force applied by the spring to the wedge (damping ratio) is variable by altering the engagement between the load application member and the wedge and hence the direction.

[0006] In one embodiment one of the member or wedge may have a generally flat engagement face and the other may have a non-planar face whereby the flat face can pivot on the non-planar face to alter the direction.

[0007] It will be appreciated that by altering the direction the size of the horizontal damping force component is varied non-linearly and hence non-linear variations of the damping ratio can be achieved.

[0008] In a particularly preferred embodiment the load application member is pivotally mounted and further includes a resilient element for urging the load application member against the wedge. Preferably the resilient element is rated to be fully compressed at the design maximum load of the vehicle. For freight vehicles, it would

normally be desired that the resilient member is sufficiently strong to maintain the plate in a first pivoted position, when the vehicle is unladen or at tare weight, and to be fully compressed when the vehicle is in at least a substantially loaded state. In this way the suspension can provide a first damping ratio which is suitable for tare running and a second damping ratio which is suitable for laden running, but more sophisticated arrangements can be envisaged, for example the resilient element could be replaced by an hydraulic ram, which altered the angle of the plate either under manual control or automatically in response to a detected load in the vehicle.

[0009] For freight vehicles it is particularly preferred that in one state the direction is substantially 30° to horizontal and in another state the direction is substantially at 40° to the horizontal.

[0010] Although the invention has been defined above it is to be understood that it includes any inventive combination of the features set out above or in the following description.

[0011] The invention may be performed in various ways and a specific embodiment will now be described, by way of example, with reference to the accompanying drawings in which:

Figure 1a is a vertical view of a bogie set for tare running; and

Figure 1b is the equivalent view of the left hand side of the bogie of Figure 1 a in its fully laden condition.

A bogie 10 includes a top pedestal 11, that supports the body, for example, of a railway wagon (not shown), an axle box 12 which is attached to a wheel set 13 by a bearing 14, and a suspension system, generally indicated at 15 acting between the pedestal 11 and the axle box 12.

[0012] The suspension 15 includes two upper load bearing springs 16 mounted on respective sides of a centre line 17 and a pair of damping spring sets 18, which are also mounted on respective sides of the centre line 17.

[0013] Each spring sets 18 includes coaxial springs 19 which together support a wedge 20 that is constrained to travel vertically by the engagement of its face 21 with the vertical face 22 on the axle box 12. Up to this point the design is entirely conventional.

[0014] However, instead of the pedestal 11 having a fixed inclined face for engaging the upper surface of the wedge 20, a pivoted plate 24 is provided. As will be seen in Figure 1 a the plate 24 can pivot towards and away from the pedestal 11. It will also be seen that the upper face of the wedge 20 is domed, rather than flat as in the conventional design, so that as the plate 24 pivots, it can be readily aligned on the upper surface of the wedge 20 to vary the line of action of the force transmitted through the plate 24 into the wedge 20. It will be understood that by changing the angle of that line of action, the magnitude of the horizontal component of that force is also changed

with the result that the friction or damping force generated between the faces 21 and 22 is altered. As this force is one of the components of the damping ratio, the net result is to change the damping ratio.

[0015] It will be specifically noted that in the design of the embodiment a further spring 25 is provided to act between the pedestal 11 and the plate 24 in a sense to urge the plate 24 away from the pedestal 11 and against the wedge 20. By choosing a suitable spring 25 it is possible to arrange for it to be in its extended position as shown in Figure 1A when the respective vehicle is in its tare condition, but the spring 25 is fully compressed (see Figure 1 b) in the laden condition of the vehicle. As will be noted this changes the angle of the face of the plate 24 from 40° in the tare condition to 30° in the laden position. The line of action or direction of transmitted load is therefore varied between 50° to the horizontal and 60° to the horizontal, with the resultant change on the resolved components of the applied load, as mentioned above.

[0016] This construction provides a particularly suitable arrangement for freight vehicles in that it acts essentially in a flip flop manner with the plate either being in its Figure 1 a or Figure 1b condition. For vehicles which have more variable loads, such as passenger vehicles, the spring 25 may be chosen for progressive compression, or a combination of springs may be used or, as is mentioned above, some positive actuator, such as a hydraulic ram could be used, but obviously that would be a more expensive approach.

Claims

1. A suspension for a rail vehicle including at least one spring (19) carrying a wedge (20) constrained to move in a vertical direction and a load application member (24) for engaging the wedge (20) to transmit load to the wedge (20) along a direction **characterised in that** the ratio of the horizontal force at the wedge vertical face to the vertical force applied by the spring (19) to the wedge (20) (damping ratio) is variable by altering the engagement between the load application member and the wedge (20) and hence the direction.
2. A suspension as claimed in claim 1 wherein one of the load application member (24) or wedge (20) has a generally flat engagement face and the other has a non-planar face whereby the flat face can pivot on the non-planar face to alter the direction.
3. A suspension as claimed in claim 2 wherein the member (24) is pivotally mounted and further including a resilient element (25) for urging load application the member (24) against the wedge (20).
4. A suspension as claimed in claim 3 wherein the re-

silient element (25) is rated to be fully compressed at the design maximum load of the vehicle.

5. A suspension as claimed in any one of the preceding claims wherein the load application member (24) is a flat plate.
6. A suspension as claimed in any one of the preceding claims wherein one direction is as substantially 50° to the vertical.
7. A suspension as claimed in claim 6 wherein another direction is at substantially 60° to the vertical.

Patentansprüche

1. Aufhängung für ein Schienen-Fahrzeug, das wenigstens eine Feder (19) aufweist, die einen Keil (20) trägt, der so eingerichtet ist, daß er sich in einer senkrechten Richtung bewegt und mit einem Lastbeaufschlagungskörper (24), der mit dem Keil (20) in Berührung steht, um längs einer Richtung eine Last auf den Keil (20) zu übertragen, **dadurch gekennzeichnet, daß** das Verhältnis der waagerechten Kraft an der senkrechten Oberfläche des Keils zur senkrechten Kraft, die durch die Feder (19) auf den Keil (20) aufgebracht wird (Dämpfungsverhältnis) variabel ist, indem der Eingriff zwischen dem Lastbeaufschlagungskörper und dem Keil (20) und damit die Richtung geändert wird.
2. Aufhängung nach Anspruch 1, **dadurch gekennzeichnet, daß** der Lastbeaufschlagungskörper (24) oder der Keil (20) eine im allgemeinen flache Berührungsfläche aufweist, während der andere der beiden genannten Teile eine unebene Fläche hat, wodurch sich die flache Fläche auf der unebenen Fläche verschwenken kann, um die Richtung zu ändern.
3. Aufhängung nach Anspruch 2, **dadurch gekennzeichnet, daß** der Körper (24) verschwenkbar gelagert ist und des weiteren ein federndes Element (25) aufweist, um den Lastbeaufschlagungskörper (24) gegen den Keil (20) zu drücken.
4. Aufhängung nach Anspruch 3, **dadurch gekennzeichnet, daß** das federnde Element (25) so bemessen ist, daß es bei der konstruktiv ausgelegten maximalen Belastung des Fahrzeugs vollständig zusammengepreßt ist.
5. Aufhängung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß** der Lastbeaufschlagungskörper (24) eine flache Platte ist.
6. Aufhängung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß** die eine

Richtung im wesentlichen 50 ° zu der Senkrechten ist.

7. Aufhängung nach Anspruch 6, **dadurch gekennzeichnet, daß** die andere Richtung im wesentlichen 60 ° zu der Senkrechten ist. 5

Revendications

- 10
1. Suspension pour un véhicule ferroviaire comprenant au moins un ressort (19) portant une cale (20) contrainte de se déplacer dans une direction verticale et un organe d'application de charge (24) pour se mettre en prise avec la cale (20) afin de transmettre une charge à la cale (20) dans une direction, **caractérisée en ce que** le rapport de la force horizontale à la face verticale de la cale sur la force verticale appliquée par le ressort (19) à la cale (20) (rapport d'amortissement) est variable en altérant la mise en prise entre l'organe d'application de charge et la cale (20) et donc la direction. 15
2. Suspension selon la revendication 1, dans laquelle l'un de l'organe d'application de charge (24) ou de la cale (20) a une face de mise en prise généralement plate et l'autre a une face non plane, de telle manière que la face plate puisse pivoter sur la face non plane pour altérer la direction. 20
- 30
3. Suspension selon la revendication 2, dans laquelle l'organe d'application de charge (24) est monté de manière à pouvoir pivoter et comprend en outre un élément élastique (25) pour amener l'organe d'application de charge (24) contre la cale (20). 35
4. Suspension selon la revendication 3, dans laquelle l'élément élastique (25) est calibré pour être entièrement compressé à la charge maximale de conception du véhicule. 40
5. Suspension selon l'une quelconque des revendications précédentes, dans laquelle l'organe d'application de charge (24) est une plaque plate. 45
6. Suspension selon l'une quelconque des revendications précédentes, dans laquelle une direction est sensiblement 50° par rapport à la verticale. 50
7. Suspension selon la revendication 6, dans laquelle une autre direction est sensiblement 60° par rapport à la verticale. 55

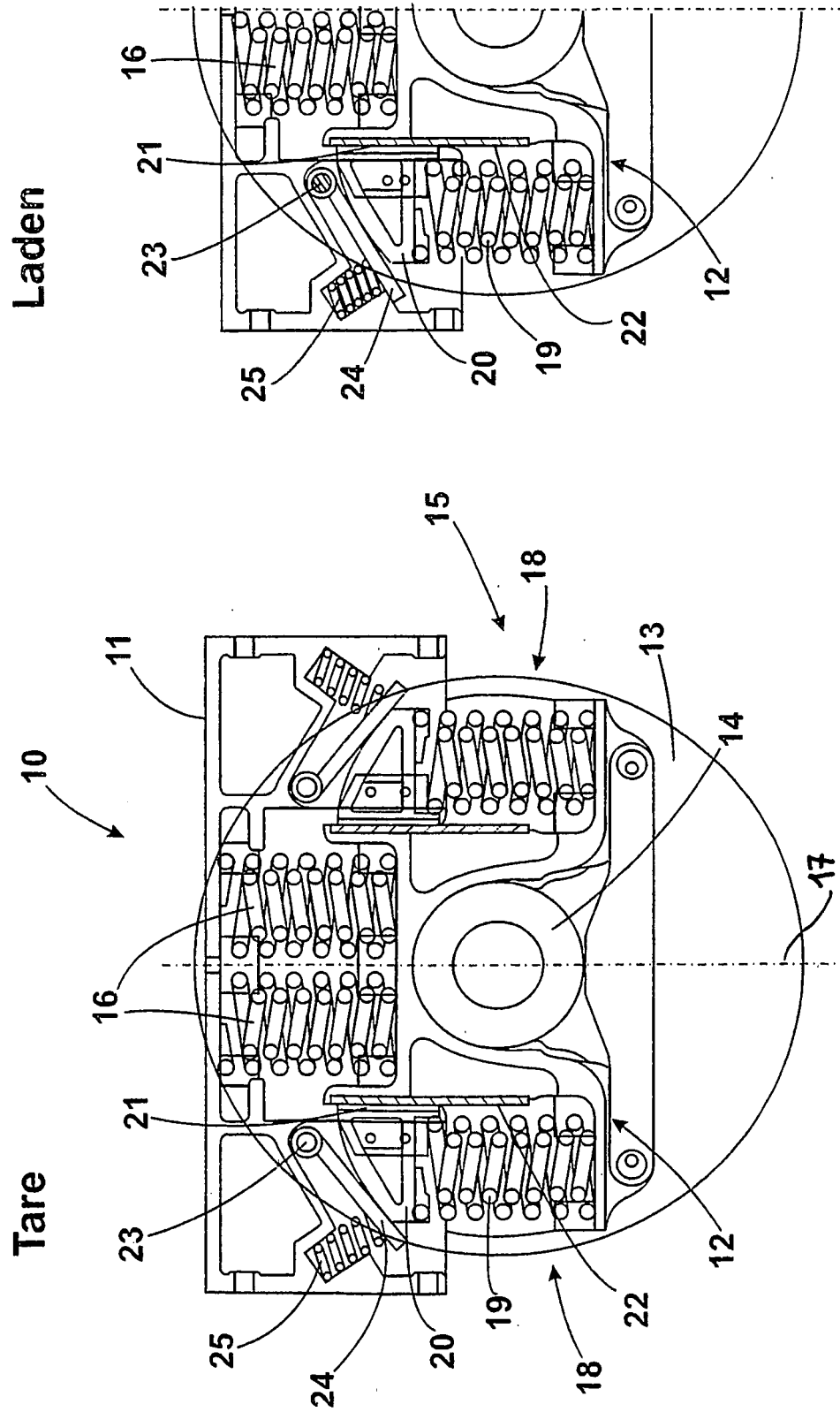


Fig. 1b

Fig. 1a

REFERENCES CITED IN THE DESCRIPTION

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