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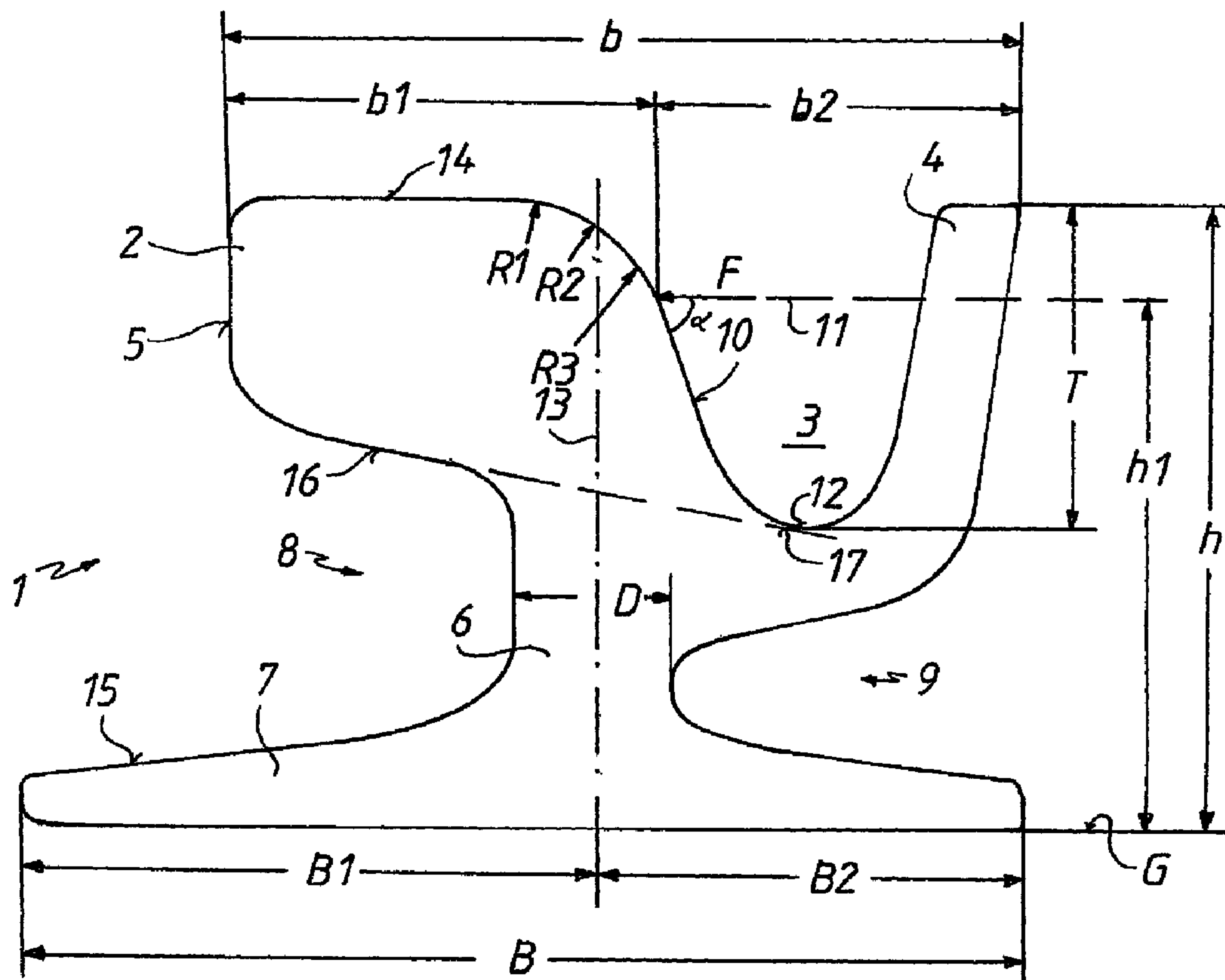
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(57) **Abrégé/Abstract:**

The invention relates to a grooved rail for rail vehicles provided with flange wheels, said grooved rail comprising a rail head (5) provided with a running rail (2), a flange groove (3), and a counterrail (4), in addition to a rail web (6), a rail base (7), and lateral rail

(57) **Abrégé(suite)/Abstract(continued):**

chambers (8,9) extending between the rail head and the rail base. The running rail comprises a vehicle-guiding flange (10) extending towards the flange groove, said flange being asymmetrically arranged in relation to the rail head, when the depth of the flange groove is more than $> 20\text{mm}$ in relation to an essentially horizontally extending axis (11) of the rail web, in such a way that the width part (B1) of the rail base, on the side of the running rail, is larger, at least by the factor 1.2, than the width part (B2) on the side of the counterrail.

Abstract

The invention relates to a grooved rail for rail vehicles provided with flange wheels, said grooved rail comprising a rail head (5) provided with a running rail (2), a flange groove (3), and a counterrail (4), in addition to a rail web (6), a rail base (7), and lateral rail chambers (8,9) extending between the rail head and the rail base. The running rail comprises a vehicle-guiding flange (10) extending towards the flange groove, said flange being asymmetrically arranged in relation to the rail head, when the depth of the flange groove is more than $> 20\text{mm}$ in relation to an essentially horizontally extending axis (11) of the rail web, in such a way that the width part (B1) of the rail base, on the side of the running rail, is larger, at least by the factor 1.2, than the width part (B2) on the side of the counterrail.

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Grooved rail

The invention relates to a grooved rail for rail vehicles provided with flange wheels.

Grooved rails have already been known for many decades, wherein the constructional structure thereof has hardly changed over the time.

Herein reference is made to for example DE 70438 as well as DE 195 39 590.

Grooved rails according to the state of the art which are inertia rails, i.e. with web thicknesses of $< 50\%$ of the rail head width, often have a cross section with a slim shape.

With regard to modifications of the rail vehicles that roll on the grooved rails, in particular the flange wheels thereof, such profiles can no more used efficiently, since there will be more wear due to stronger transverse forces, in particular in the region of the flange grooves respectively the flanges which are present there.

FR-A 2816967 discloses a grooved rail for rail vehicles provided with flange wheels, said grooved rail comprising a rail head provided with a running rail, a flange groove as well as a counterrail, in addition to a rail web, a rail base and lateral rail chambers extending between the rail head and the rail base, wherein the running rail comprises a vehicle guiding flange extending towards the flange groove. Herein, the rail shall have a total height of approximately 85 mm, whereas a width of about 130 mm is indicated for the rail base.

WO 01/83889 inter alia treats a grooved rail that has a total cross section, the essential portions of which are bordered like a shoe.

It is the object of some embodiments of the subject of invention to provide a grooved rail profile that meets the actual requirements with regard to substantially lesser roadway thicknesses, for example solid roadways, in particular of road constructions, that can be easily produced and that is also able to receive essentially horizontal transverse forces with a safe, in particular elastic, support on the soil or components that cooperate therewith.

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This aim is achieved in that the flange has a flange inclination (α) of $< 78^\circ$ with respect to an essentially horizontal axis of the rail head, when the depth of the flange groove (T) is > 20 mm, i.e. in case of a deep groove, that the rail base comprising a pre-determinable total width is asymmetrically arranged with respect to the rail head with reference to the vertical central axis of the rail web, such that the width part of the rail base, on the side of the running rail, is larger at least by the factor 1.2 than the width part on the side of the counterail and that the width of the running rail is comprised between 55 and 65% of the total width of the rail head.

In comparison to the state of the art, a profile can thus be provided that has a relatively small constructional height (≤ 100 mm). A grooved rail profile is defined such that an enlarged running rail is obtained in combination with a reduced inclination angle of the flange with respect to the state of the art which causes less wear, on the one hand, and a better resistance to transverse forces, on the other hand, in that the proportion of the width parts of the rail base in connection with the enlarged web thickness and the reduced lever arm of the application of force cause the horizontal excursion of the rail head to be reduced towards the base point.

Furthermore, the modified flange inclination angle still has advantages with respect to the tracking in comparison to the state of the art, in particular for curved running, whereby the travel comfort is improved.

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According to one aspect of the present invention, there is provided a grooved rail for rail vehicles provided with flange wheels, said grooved rail comprising a rail head provided with a running rail, a flange groove, as well as a counterrail, in addition to a rail web, a rail base and lateral rail chambers extending
5 between the rail head and the rail base, wherein the running rail comprises a vehicle guiding flange extending towards the flange groove, said flange having a flange inclination of less than 78° with respect to an essentially horizontal axis of the rail head, when the depth of the flange groove is greater than 20 mm, the rail base comprising a pre-determinable total width is asymmetrically arranged with
10 respect to the rail head with reference to the vertical central axis of the rail web comprising a pre-determinable total thickness, such that the width part of the rail base, on the side of the running rail, is larger at least by the factor 1.2 than the width part on the side of the counterrail and that a width of the running rail is comprised between 55 and 65% of the total width of the rail head; and wherein the
15 ratio between the total height of the grooved rail and the total width of the rail head is comprised between 1:1.2 and 1:1.4.

According to another aspect of the present invention, there is provided a grooved rail for flange-wheeled rail vehicles, the grooved rail comprising a rail head provided with a running rail whose width is 55 to 65% of the
20 total width of the rail head, a flange groove, a counterrail, a rail web, a rail base and lateral rail chambers extending between the rail head and the rail base, wherein the running rail comprises a vehicle guiding flange extending towards the flange groove, the guiding flange having a flange inclination of less than 78° with respect to an essentially horizontal axis of the rail head when depth of the flange
25 groove is greater than 20 mm, total width of the rail base being asymmetrically arranged with reference to a vertical central axis of the rail web, the total width of the rail base consisting of a first part on a first side of the vertical axis and a second portion on a second side of the vertical axis including the counterrail, the first portion being larger than the second portion by a factor of at least 1.2; and
30 further wherein the ratio of total height of the grooved rail to the total width of the rail head is from 1:1.2 to 1:1.4, the total height of the grooved rail to the total width of the rail base is from 1:1.5 to 1:1.8, the ratio of the total width of the rail head to

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the total width of the rail base is from 1:1.2 to 1:1.4, and the ratio of the thickness of the rail web to the total width of the rail base is from 1:4 to 1:9.

The subject of invention may be represented in the drawing by means of an exemplary embodiment and is described as follows.

5 The only exemplary embodiment shows a schematic diagram, not necessarily in correct scale, of the profile of a grooved rail 1 which, in this example, shall be installed on a solid roadway made of concrete. The grooved rail 1 comprises a rail head 5 provided with a running rail 2, a flange groove 3 as well as a counterrail 4, in addition to a rail web 6 and a rail base 7. Lateral rail
10 chambers 8, 9 that have a different height extend between the rail head 5 and the rail base 7. The running rail 2 comprises a vehicle guiding flange 10 that extends towards the flange groove 3. With respect to an imagined horizontal axis 11 the flange 10 extends in the direction of the groove bottom 12 of the flange groove 3 with an inclination angle α that shall be 76° in this example. The gradient of the
15 flange 10 is thus approximately 1:4.0. The rail head 5 has a total width b, wherein the portion of the running rail b1 is formed with respect to the remaining portion

b2, such that the width b1 of the running rail 2 corresponds to the rolling width of a usual tire of 95 mm and is 57% of the total width b of the rail head 5 in this example.

The rail base 7 comprising a pre-determinable total width B is asymmetrically arranged with respect to the rail head 5, such that the width part B1 on the side of the running rail is larger by the factor 1.4 than the width part B2 on the side of the counterail in this example. Herein, reference is made to the vertical central axis 13 of the rail web 6 comprising a pre-determinable thickness D. The running surface 14 of the running rail 2 extends over several radii R1, R2, R3 into the vehicle guiding flange 10, wherein the radius R1 becomes continuously smaller in the direction of R3 via R2 that verge into each other. The total height of the grooved rail 1 is indicated with h. Herein the base is the area G of the rail base. The flange groove 3 which is realised as deep groove has a total depth T. In this example the ratio between the total height h of the grooved rail 1 and the total width b of the rail head shall be 1:1.25. The ratio between the total height h of the grooved rail 1 and the total width B of the rail base 7 shall be 1:1.65 in this example. The ratio between the total width b of the rail head 5 and the total width B of the rail base 7 shall be approximately 1:1.3 in this example.

The ratio between the groove depth T and the total height h of the grooved rail 1 is minimum 1:2. The ratio between the thickness D of the rail web 6 and the total width B of the rail base 7 shall be approximately 1:7 in this example.

The rail chamber 8 on the side of the running rail is defined by a flange 15 on the side of the rail base and a flange 16 on the side of the running rail, which flanges suitably extend towards each other.

The imagined prolongation 17 of the flange 16 on the side of the running rail intersects the groove bottom of the flange groove 3 in this example.

Thanks to the profile of the grooved rail 1 that is defined in the claims and that has a small constructional height h and an optimized width B of the rail base 7 in connection with the indicated flange angle α with an approximately horizontal application of force F by the flange wheel of a no further represented rail vehicle it is possible to obtain a good support of the grooved rail 1 on a hard or elastic soil of a solid roadway without tilting

moments becoming active. The height h_1 of the horizontal application of force F on the flange 10 of the running rail 2 is comprised between 0.8 and 0.9 h of the grooved rail 1 with respect to the area G of the rail base. The width part B_1 on the side of the running rail shall satisfy the following equation in this example:

$$B_1 = B_2 + D.$$

The width b_1 of the running rail 2 shall approximately correspond to the width part B_2 of the rail base 7 on the side of the counterrail, wherein the width part B_2 on the side of the counterrail shall be $<$ the total height h of the grooved rail 1. Finally, the width part B_1 on the side of the running rail shall be $>$ than the height h_1 .

List of reference numerals

- 1. grooved rail
- 2. running rail
- 3. flange groove
- 4. counterrail
- 5. rail head
- 6. rail web
- 7. rail base
- 8. rail chamber
- 9. rail chamber
- 10. vehicle guiding flange
- 11. horizontal axis
- 12. groove bottom
- 13. central axis
- 14. running surface
- 15. flange on the side of the rail base
- 16. flange on the side of the running rail
- 17. imagined prolongation
- b. total width of rail head
- b1. width of running rail
- b2. remaining width of rail head
- h. total height of grooved rail
- h1. height of application of force of running rail
- B. total width of rail base
- B1. width part on the side of the running rail
- B2. width part on the side of the counterrail
- T. deep flange groove
- α inclination angle of flange 10
- R1. radius
- R2. radius
- R3. radius
- D. web thickness
- G. area of rail base

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CLAIMS:

1. A grooved rail for rail vehicles provided with flange wheels, said grooved rail comprising a rail head provided with a running rail, a flange groove, as well as a counterrail, in addition to a rail web, a rail base and lateral rail chambers extending between the rail head and the rail base, wherein the running rail comprises a vehicle guiding flange extending towards the flange groove, said flange having a flange inclination of less than 78° with respect to an essentially horizontal axis of the rail head, when the depth of the flange groove is greater than 20 mm, the rail base comprising a pre-determinable total width is asymmetrically arranged with respect to the rail head with reference to the vertical central axis of the rail web comprising a pre-determinable total thickness, such that a width part of the rail base, on the side of the running rail, is larger at least by the factor 1.2 than a width part on the side of the counterrail and that a width of the running rail is comprised between 55 and 65% of the total width of the rail head; and
wherein the ratio between the total height of the grooved rail and the total width of the rail head is comprised between 1:1.2 and 1:1.4.
2. A grooved rail according to claim 1, wherein an essentially horizontally extending running surface of the running rail runs into the flange via several decreasing transition radii that verge into each other.
3. A grooved rail according to any one of the claims 1 to 2, wherein the ratio between the total height of the grooved rail and the total width of the rail base is comprised between 1:1.5 and 1:1.8.
4. A grooved rail according to any one of the claims 1 to 3, wherein the ratio between the total width of the rail head and the total width of the rail base is comprised between 1:1.2 and 1:1.4.
5. A grooved rail according to any one of the claims 1 to 4, wherein the groove depth of the flange groove is at least 50% with respect to the total height of the grooved rail.

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6. A grooved rail according to any one of the claims 1 to 5, wherein the ratio between the thickness of the rail web and the total width of the rail base is comprised between 1:4 and 1:9.

7. A grooved rail according to any one of the claims 1 to 6, wherein the
5 inclination angle is less than 75°.

8. A grooved rail according to any one of the claims 1 to 7, wherein the ratio of the width part of the rail base and the width part on the side of the counterrail of the rail base is at least 1:1.3.

9. A grooved rail according to any one of the claims 1 to 8, wherein the
10 flange of the running rail that runs into the rail chamber on the side of the running rail is inclined in the direction of the rail base, such that an imagined prolongation of said flange intersects the groove bottom of the flange groove.

10. A grooved rail according to any one of the claims 1 to 9, wherein the width part on the side of the running rail satisfies the following equation:

15
$$B1 = B2 + D$$

wherein B1 is the width part on the side of the running rail

B2 is the width part on the side of the counterrail

D is the thickness of the web.

11. A grooved rail according to any one of the claims 1 to 10, wherein
20 the width of the running rail essentially corresponds to the width part on the side of the counterrail, wherein the width part on the side of the counterrail is less than the total height of the grooved rail.

12. A grooved rail according to any one of the claims 1 to 11, wherein
25 the width part on the side of the running rail is equal to or greater than the height of the application of force on the running rail with respect to the area of the rail base.

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13. A grooved rail for flange-wheeled rail vehicles, the grooved rail comprising a rail head provided with a running rail whose width is 55 to 65% of the total width of the rail head, a flange groove, a counterrail, a rail web, a rail base and lateral rail chambers extending between the rail head and the rail base,

5 wherein

the running rail comprises a vehicle guiding flange extending towards the flange groove, the guiding flange having a flange inclination of less than 78° with respect to an essentially horizontal axis of the rail head when depth of the flange groove is greater than 20 mm, total width of the rail base being

10 asymmetrically arranged with reference to a vertical central axis of the rail web, the total width of the rail base consisting of a first part on a first side of the vertical axis and a second portion on a second side of the vertical axis including the counterrail, the first portion being larger than the second portion by a factor of at least 1.2; and further wherein

15 the ratio of total height of the grooved rail to the total width of the rail head is from 1:1.2 to 1:1.4,

the total height of the grooved rail to the total width of the rail base is from 1:1.5 to 1:1.8,

the ratio of the total width of the rail head to the total width of the rail

20 base is from 1:1.2 to 1:1.4, and

the ratio of the thickness of the rail web to the total width of the rail base is from 1:4 to 1:9.

14. The grooved rail according to claim 16, wherein the depth of the flange groove is at least 50% of total height of the grooved rail.

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