

(19)



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(11)

EP 1 283 923 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:

13.10.2004 Bulletin 2004/42

(21) Application number: **01935838.1**

(22) Date of filing: **25.05.2001**

(51) Int Cl.7: **E01B 9/68**, E01B 19/00

(86) International application number:
PCT/BE2001/000092

(87) International publication number:
WO 2001/090483 (29.11.2001 Gazette 2001/48)

(54) **Method for laying a railway and railway obtainable by the method**

Verfahren zum Einlegen eines Gleises und dadurch hergestellten Gleis

Méthode de pose d'une voie ferrée et voie ferrée obtenue par la méthode

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE TR**

(30) Priority: **25.05.2000 BE 200000351**

(43) Date of publication of application:
19.02.2003 Bulletin 2003/08

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Description

[0001] The invention concerns a method for laying a railway with rails which rest on a support over substantially their entire length, whereby a vibration isolating strip, containing a first layer and a second layer with a different rigidity, situated on top of one another, is provided between the rails and the support. The invention also concerns a railway with rails which rest on a support, whereby a vibration-isolating strip is provided between the support and the rails.

[0002] According to the state of the art, a strip is used consisting of a first layer with a low rigidity for the isolation of the vibrations, whereas a second layer mainly functions as a protective layer for the first layer. Such strips are described for example in EP-A-0 726 359 and US-A-5 011 077.

[0003] In order to obtain a railway whereby as little sound or vibrations as possible are transferred to the environment via the rails, it is important that the upper surface of the rails is made almost entirely flat, whereby the rigidity of the rail is almost constant over its entire length.

[0004] According to the methods applied until now, or by means of the known vibration-isolating strips, it is not possible, however, to lay a railway with an almost perfectly flat upper surface in a simple manner. The vertical tolerances which are reached up to now are in the order of magnitude of 3 mm.

[0005] By perfectly aligning the upper surface of the rails of a railway, we can moreover reduce the wear of the rails.

[0006] The differences in height which may occur in the upper surface of the rails are among others due to tolerances in the height of the rails themselves, the bearing capacity of the base and the thickness of the support of the rails.

[0007] The invention aims to remedy these disadvantages by introducing a method and a vibration-isolating strip which make it possible to lay a railway in a simple manner whereby the upper surface of the rails is very precisely aligned. Moreover, the method and the strip according to the invention offer an additional advantage in that rails can be easily replaced by new rails which are very precisely aligned, without the necessity of breaking away the support for the rails.

[0008] This aim is achieved by the method according to appended claim 1, in which, when the rails are laid and/or aligned, mainly said first layer, having the lowest rigidity, is compressed until its rigidity is at least of the same order of magnitude as that of said second layer.

[0009] Practically, the first layer is compressed until its thickness amounts to 25 to 50%, and in particular 30 to 40%, of its original thickness.

[0010] According to a special embodiment of the method according to the invention, a material is selected for said first layer whose rigidity is at least five times smaller than the rigidity of said second layer.

[0011] According to a specific embodiment of the method according to the invention, a material is selected for said first layer having a rigidity between 10 and 25 MN/m³, and which amounts in particular to almost 20 MN/m³.

[0012] According to a preferred embodiment of the method according to the invention, a material is selected for said second layer with a rigidity between 50 and 150 MN/m³, and which amounts in particular to almost 110 MN/m³.

[0013] The railway according to the invention as defined by appended claim 8 is provided with a vibration-isolating strip which has a first layer and a second layer situated on top of one another whereby, when not compressed, the rigidity of said first layer is smaller than that of said second layer. This strip is compressed between the rails of a railway and the support for these rails, whereby, in the compressed strip, the rigidity of said first layer is at least of the same order of magnitude as that of the second layer.

[0014] According to a preferred embodiment of the railway according to the invention, said first layer mainly consists of a material having a rigidity which is at least five times smaller than the rigidity of said second layer.

[0015] According to a special embodiment of the railway according to the invention, said first layer mainly consists of a material with a rigidity situated between 10 and 25 MN/m³, and which amounts in particular to almost 20 MN/m³.

[0016] Preferably, said second layer mainly consists of a vibration-isolating material with a rigidity situated between 50 and 150 MN/m³, and which amounts in particular to almost 110 MN/m³.

[0017] Other particularities and advantages of the invention will become clear from the following description of a few special embodiments of the invention; this description is given as an example only and does not restrict the scope of the claimed protection in any way; the reference figures used hereafter refer to the accompanying drawing.

[0018] This figure is a schematic cross section of a rail from a railway with a strip according to the invention. For clarity's sake, the part of the figure to the left of line I-I represents a situation in which the rail rests on the strip when it is not compressed, whereas the part of the figure to the right of line I-I represents the strip when it is compressed.

[0019] The same reference figures refer to identical or analogous elements.

[0020] The strip is mainly used for laying a continuously supported track. These are rail systems whereby the rails rest on a support over their entire length. Such a continuous support may for example consist of a concrete base or of connecting sleepers placed next to one another.

[0021] The strip 1 according to the invention, as represented in the figure, has substantially the same width as the foot 2 of a rail 3 and is provided between this foot

2 and the support 4 of the rail 3. Further, the rail 3 is fixed to the support 4 via the foot 2 by means of mounting clips 5 and 6 known as such.

[0022] The strip 1 represented in the figure consists of two layers 7 and 8 situated on top of one another. A first layer consists of an adjusting layer 7 made of a very flexible material which, as will be further described, is considerably compressed as the rail 3 is aligned. The second layer forms a damping layer 8 which makes sure that vibrations of the rail 3 are damped and that the transfer of vibrations to the support 4 is strongly reduced.

[0023] The adjusting layer 7 has what is called a static bed module which, when not compressed, is smaller than that of the damping layer 8. For the sake of convenience, the quantity static bed module will be referred to in short by the term rigidity.

[0024] For the adjusting layer 7 is preferably selected a material with a rigidity which is at least five times smaller than the rigidity of the damping layer 8. Thus, the rigidity of the adjusting layer 7 amounts to for example 20 MN/m³, whereas the rigidity of the damping layer amounts to for example 110 MN/m³.

[0025] In general, a material is preferably selected for the adjusting layer 7 with a rigidity situated between 10 and 25 MN/m³, and a material is used for the damping layer 8 having a rigidity which is preferably situated between 50 and 300 MN/m³, in particular between 50 and 150 MN/m³.

[0026] When a railway is laid according to the method of the invention, the rail 3 will be aligned during or after the positioning of the latter on the strip 1. This implies that the mounting clips 5 and 6 are tightened via bolts, which are not represented in the figure, so as to firmly connect the rail 3 to the support 4, whereby, near the corresponding mounting clips 5 and 6, a specific vertical movement is imposed on the rail 3 so as to make the upper surface 9 of the rail 3 completely flat over its entire length.

[0027] By thus providing a clamping force on the mounting clips, the adjusting layer 7 is compressed until its rigidity amounts to at least the same order of magnitude as that of said damping layer 8. The compressed layer 7 is preferably more rigid than the damping layer 8. The compression of the adjusting layer 7 makes sure that possible vertical deviations of the support 4 or of the thickness of the rails 3 are compensated for by a corresponding compression of the adjusting layer 7.

[0028] In particular, the adjusting layer 7 is compressed to a thickness which amounts to 25 to 50%, and in particular to 30 to 40% of its original thickness.

[0029] In the figure, the strip 1 is represented in a non-compressed condition to the left of line I-I. The mounting clip 5 is situated in a corresponding position and is sufficiently tightened to connect the rail 3 to the support 4 in a provisional manner. To the right of line I-I, the strip 1 is represented as compressed. The mounting clip 6 is hereby tightened such that the rail 3 is firmly connected

to the support 4, whereas the upper surface of the rail 3 is aligned.

[0030] As can be clearly derived from this figure, the adjusting layer 7 is compressed to almost 40% of its original thickness, whereas the damping layer 8 is subjected to a relatively small compression.

[0031] In order to make the isolation of the rail 3 in relation to the support 4 optimal, a connecting piece which is not represented in the figure is provided between the mounting clips 5 and 6 and the foot 2, forming an acoustic partition. This connecting piece is made for example of a cork/rubber elastomer which is internally reinforced with synthetic fibres known under the brand name "Kevlar".

[0032] In a particularly interesting embodiment of the method and the strip, the adjusting layer 7 consists of a microcellular rubber having a rigidity of 20 MN/m³, whereas, for the damping layer 8, an elastomer known as such is used having a rigidity of 110 MN/m³. The thickness of the damping layer 8 amounts for example to 12 mm, whereas that of the adjusting layer 7 in a non-compressed condition amounts to 10 mm. When the rails 3 are laid, the adjusting layer 7 is compressed to about 4 mm.

[0033] When the rails 3 have to be replaced due to wear, one only has to remove them from the support 4 and mount new rails 3 instead without breaking away the support 4. It is sufficient to mount the new rails again by means of the strip 1, and to align them by tightening the mounting clips 5 and 6, such that a suitable compression of the adjusting layer 7 is obtained.

[0034] Naturally, the invention as defined by the appended claims is not restricted to the above-described method and strip. Thus, the strip may consist for example of more than two layers lying on top of one another, some of which having a different rigidity, or it may have standing edges which enclose the foot of the rail at least partially. Of course, the width of the strip is not necessarily equal to the width of the rails.

[0035] The different layers of a strip may also continuously merge into one another, such that a strip is obtained which has a varying rigidity fluctuation according to a vertical direction.

[0036] Further, contrary to what is represented in the figure, the adjusting layer may also form the top layer of a strip.

Claims

1. Method for laying a railway with rails (3) which rest on a support (4) over substantially their entire length, whereby a vibration-isolating strip (1), containing a first and a second layer (7,8) lying on top of one another and having a different rigidity, is provided between the rails (3) and the support (4), **characterised in that**, when the rails (3) are laid and/or aligned, mainly said first layer (7), having the

lowest rigidity, is compressed until its rigidity is of at least the same order of magnitude as that of said second layer (8).

2. Method according to claim 1, **characterised in that** said first layer (7) is compressed until its thickness amounts to 25 to 50%, and in particular 30 to 40%, of its original thickness. 5
3. Method according to claim 1 or 2, **characterised in that** microcellular rubber is used for said first layer (7). 10
4. Method according to any of claims 1 to 3, **characterised in that** an elastomer is used for said second layer (8). 15
5. Method according to any of claims 1 to 4, **characterised in that** a material is selected for said first layer (7) having a rigidity which is at least five times smaller than the rigidity of said second layer (8). 20
6. Method according to any of claims 1 to 5, **characterised in that** a material is selected for said first layer (7) having a rigidity which is situated between 10 and 25 MN/m³, and which amounts in particular to about 20 MN/m³. 25
7. Method according to any of claims 1 to 6, **characterised in that** a material is selected for said second layer (8) having a rigidity which is situated between 50 and 150 MN/m³, and which amounts in particular to about 110 MN/m³. 30
8. Railway with rails (3) which rest on a support (4), whereby a vibration-isolating strip (1) is provided between the support (4) and the rails (3) resting over substantially their entire length on said strip (1), whereby the strip (1) has a first layer (7) and a second layer (8) situated on top of one another, **characterised in that** the rigidity of said first layer (7), when not compressed, is smaller than that of said second layer (8), said strip (1) being compressed between the rails (3) and the support (4) for the rails (3), such that, in the compressed strip (1), the rigidity of said first layer (7) is at least of the same order of magnitude as that of the second layer (8). 35 40 45
9. Railway according to claim 8, **characterised in that** said first layer (7) has a material with a rigidity which is at least five times smaller than the rigidity of said second layer (8). 50
10. Railway according to claim 8 or 9, **characterised in that** said first layer (7) mainly consists of a material with a rigidity situated between 10 and 25 MN/m³, and which in particular amounts to about 20 MN/

m³.

11. Railway according to any of claims 8 to 10, **characterised in that** said second layer (8) mainly consists of a vibration-isolating material with a rigidity situated between 50 and 150 MN/m³, and which amounts in particular to about 110 MN/m³.
12. Railway according to any of claims 8 to 11, **characterised in that** said first layer (7) is at least partially made of microcellular rubber.
13. Railway according to any of claims 8 to 12, **characterised in that** said second layer (8) is at least partially made of an elastomer.
14. Railway according to any of claims 8 to 13, **characterised in that** said first layer (7), when it is not compressed, has a thickness between 10 mm and 25 mm.

Patentansprüche

1. Verfahren zum Verlegen von Gleisen mit Schienen (3), die im wesentlichen über ihre gesamte Länge auf einer Trägervorrichtung (4) ruhen, wobei ein Vibrationsdämpfungsstreifen (1), der eine erste und eine zweite Schicht (7, 8) enthält, die übereinander liegen und eine unterschiedliche Steifigkeit haben, zwischen den Schienen (3) und der Trägereinrichtung (4) angebracht wird, **dadurch gekennzeichnet, daß**, wenn die Schienen (3) verlegt und/oder ausgerichtet werden, hauptsächlich die erste Schicht (7), die die geringste Steifigkeit aufweist, zusammengepreßt wird, bis ihre Steifigkeit wenigstens in derselben Größenordnung liegt, wie jene der zweiten Schicht (8).
2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, daß** die erste Schicht (7) zusammengepreßt wird, bis ihre Dicke 25 bis 50%, vorzugsweise jedoch 30 bis 40% ihrer ursprünglichen Dicke beträgt.
3. Verfahren nach Anspruch 1 oder 2, **dadurch gekennzeichnet, daß** ein mikrozellulärer Gummi für die erste Schicht (7) verwendet wird.
4. Verfahren nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, daß** ein Elastomer für die zweite Schicht (8) verwendet wird.
5. Verfahren nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, daß** für die erste Schicht (7) ein Material verwendet wird, dessen Steifigkeit wenigstens fünfmal geringer ist als die Steifigkeit der zweiten Schicht (8).

6. Verfahren nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, daß** für die erste Schicht (7) ein Material gewählt ist, das eine Steifigkeit hat, die zwischen 10 und 25 MN/m³ liegt, die insbesondere jedoch etwa 20 MN/m³ beträgt.

7. Verfahren nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, daß** für die zweite Schicht (8) ein Material gewählt ist, das eine Steifigkeit zwischen 50 und 150 MN/m³ hat, die vorzugsweise jedoch etwa 110 MN/m³ beträgt.

8. Gleis mit Schienen (3), die auf einer Trägereinrichtung (4) ruhen, wobei ein Vibrationsdämpfungsstreifen (1) zwischen der Trägereinrichtung (4) und den Schienen (3) vorgesehen ist, die im wesentlichen über ihre gesamte Länge auf dem Streifen (1) ruhen, wobei der Streifen (1) eine erste Schicht (7) und eine zweite Schicht (8) aufweist, die übereinanderliegen, **dadurch gekennzeichnet, daß** die Steifigkeit der ersten Schicht (7) im unkomprimierten Zustand geringer ist als jene der zweiten Schicht (8) und der Streifen (1) zwischen den Schienen (3) und der Trägereinrichtung (4) für die Schienen (3) derart zusammengepreßt ist, daß im zusammengepreßten Streifen (1) die Steifigkeit der ersten Schicht (7) wenigstens in derselben Größenordnung liegt wie jene der zweiten Schicht (8).

9. Gleis nach Anspruch 8, **dadurch gekennzeichnet, daß** die erste Schicht (7) aus einem Material mit einer Steifigkeit besteht, die wenigstens fünfmal geringer ist als die Steifigkeit der zweiten Schicht (8).

10. Gleis nach Anspruch 8 oder 9, **dadurch gekennzeichnet, daß** die erste Schicht (7) hauptsächlich aus einem Material mit einer Steifigkeit besteht, die zwischen 10 und 25 MN/m³ liegt, die im besonderen jedoch etwa 20 MN/m³ beträgt.

11. Gleis nach einem der Ansprüche 8 bis 10, **dadurch gekennzeichnet, daß** die zweite Schicht (8) hauptsächlich aus einem Vibrationsdämpfungsmaterial mit einer Steifigkeit besteht, die zwischen 50 und 150 MN/m³ liegt, die jedoch vorzugsweise etwa 110 MN/m³ beträgt.

12. Gleis nach einem der Ansprüche 8 bis 11, **dadurch gekennzeichnet, daß** die erste Schicht (7) wenigstens teilweise aus einem mikrozellularen Gummi besteht.

13. Gleis nach einem der Ansprüche 8 bis 12, **dadurch gekennzeichnet, daß** die zweite Schicht (8) wenigstens teilweise aus einem Elastomer besteht.

14. Gleis nach einem der Ansprüche 8 bis 13, **dadurch gekennzeichnet, daß** die erste Schicht (7) im un-

komprimierten Zustand eine Dicke zwischen 10 mm und 25 mm hat.

5 Revendications

1. Méthode de pose d'une voie ferrée dont les rails (3) reposent sur un support (4) sur sensiblement la totalité de leur longueur, dans laquelle une bande d'isolation contre les vibrations (1), comprenant une première et une deuxième couches (7, 8) disposées l'une au-dessus de l'autre et ayant une rigidité différente, est placée entre les rails (3) et le support (4), **caractérisée en ce que**, lorsque les rails (3) sont posés et/ou alignés, principalement ladite première couche (7), ayant la rigidité la plus faible, est comprimée jusqu'à ce que sa rigidité soit au moins du même ordre de grandeur que celle de ladite deuxième couche (8).

2. Méthode selon la revendication 1, **caractérisée en ce que** ladite première couche (7) est comprimée jusqu'à ce que son épaisseur corresponde à 25 % à 50 %, et en particulier à 30 % à 40 %, de son épaisseur originale.

3. Méthode selon la revendication 1 ou 2, **caractérisée en ce que** l'on utilise du caoutchouc micro-cellulaire pour ladite première couche (7).

4. Méthode selon l'une quelconque des revendications 1 à 3, **caractérisée en ce que** l'on utilise un élastomère pour ladite deuxième couche (8).

5. Méthode selon l'une quelconque des revendications 1 à 4, **caractérisée en ce que** l'on sélectionne pour ladite première couche (7) un matériau dont la rigidité est au moins cinq fois plus petite que la rigidité de ladite deuxième couche (8).

6. Méthode selon l'une quelconque des revendications 1 à 5, **caractérisée en ce que** l'on sélectionne pour ladite première couche (7) un matériau dont la rigidité est comprise entre 10 et 25 MN/m³, et qui est en particulier égale à environ 20 MN/m³.

7. Méthode selon l'une quelconque des revendications 1 à 6, **caractérisée en ce que** l'on sélectionne pour ladite deuxième couche (8) un matériau dont la rigidité est comprise entre 50 et 150 MN/m³, et qui est en particulier égale à environ 110 MN/m³.

8. Voie verrée comprenant des rails (3) qui reposent sur un support (4), dans laquelle une bande d'isolation contre les vibrations (1) est placée entre le support (4) et les rails (3) qui reposent sensiblement sur la totalité de leur longueur sur ladite bande (1), dans laquelle la bande (1) comprend une première

couche (7) et une deuxième couche (8) disposées l'une au-dessus de l'autre, **caractérisée en ce que** la rigidité de ladite première couche (7), lorsqu'elle n'est pas comprimée, est plus petite que celle de ladite deuxième couche (8), ladite bande (1) étant comprimée entre les rails (3) et le support (4) des rails (3), de telle sorte que, lorsque la bande (1) est comprimée, la rigidité de ladite première couche (7) est au moins du même ordre de grandeur que celle de ladite deuxième couche (8).

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9. Voie ferrée selon la revendication 8, **caractérisée en ce que** ladite première couche (7) est constituée d'un matériau dont la rigidité est au moins cinq fois plus petite que la rigidité de ladite deuxième couche (8).

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10. Voie ferrée selon la revendication 8 ou 9, **caractérisée en ce que** ladite première couche (7) est principalement constituée d'un matériau dont la rigidité est comprise entre 10 et 25 MN/m³, et qui est en particulier égale à environ 20 MN/m³.

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11. Voie ferrée selon l'une quelconque des revendications 8 à 10, **caractérisée en ce que** ladite deuxième couche (8) est principalement constituée d'un matériau d'isolation contre les vibrations dont la rigidité est comprise entre 50 et 150 MN/m³, et qui est en particulier égale à environ 110 MN/m³.

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12. Voie ferrée selon l'une quelconque des revendications 8 à 11, **caractérisée en ce que** la première couche (7) est au moins partiellement constituée de caoutchouc micro-cellulaire.

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13. Voie ferrée selon l'une quelconque des revendications 8 à 12, **caractérisée en ce que** la deuxième couche (8) est au moins partiellement constituée d'un élastomère.

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14. Voie ferrée selon l'une quelconque des revendications 8 à 13, **caractérisée en ce que** ladite première couche (7), lorsqu'elle n'est pas comprimée, présente une épaisseur comprise entre 10 mm et 25 mm.

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