SUPPLEMENT FOR RAILWAY SLEEPER

A supplement (1) for concrete sleepers, to be applied on the upper surface of a railway sleeper (2) for modifying the geometry of said sleeper, wherein it comprises a lower surface complementary to the geometry of the upper surface (2') of the sleeper and at least one outer surface, and wherein the material of the supplement (1) has a Young's modulus lower than the Young's modulus of said concrete sleeper (2).
DESCRIPTION

OBJECT OF THE INVENTION

[0001] The present invention, a supplement for a railway sleeper, relates to an element that is specially designed to provide a practical and economical means to modify the geometry of the surface of standard sleepers already manufactured, and preferably installed, in order to be able to modify their characteristics, transforming, for example, a standard or current sleeper into a sleeper that minimises noise or the flight of ballast.

[0002] The scope of the present invention concerns the railway sector, specifically focusing on the field of construction, renovation of tracks, and mainly adaptation of tracks, without replacing the existing standard sleepers in those tracks, on which railway vehicles circulate, particularly high-speed railway vehicles.

BACKGROUND OF THE INVENTION

[0003] As is known, of the elements that make up the track, the sleepers perform different functions on the track in which they are placed, such as the transmission of forces generated during transit of railway vehicles from the rail to the surface of the sleeper support, fastening of the rails in their position and maintaining the distance between the rails constant among others.

[0004] There are also new sleepers with specific designs for certain specific functions. Thus, there are new sleepers with specific shapes to minimise the flight of ballast, which is only important in high speed lines up to 320 km/h, but these are monolithic solutions that do not solve, unless a renewal of the track is made, the flight of ballast on tracks already in service since they require the complete replacement of the standard or current sleeper, leading to the removal of the sections of track already installed for its replacement with the new monolithic sleepers with the modified geometry.

[0005] It is known the patent application No.ES 2419554A1 referred to a "Railway aerodynamic sleeper" which describes a new monolithic sleeper with specific geometry to minimise said flying ballast effect, which comprises a central zone, two support zones each side of the central zone, on which the rails are laid, and two outer zones located at the ends of the sleeper, continuing from the support zones, and whose cross section comprises a first lower section comprising a first polygon with at least 4 sides and a second upper section comprising at least one second polygon with four or more sides, having a longitudinal edge which marks the transition between said two sections whose inclination varies according to where it is in the three distinct zones of the sleeper.

[0006] The manufacture of a new sleeper not only involves making new moulds with the consequent economic investment compounded when dealing with applications for high speed with high precision geometric requirements and prospects of very little use being much of the network already completed, but also the making of a structural design, which involves a framework design, pre-stressing forces, calculations and mechanical tests, both in the laboratory and in sections of provisional track, destined to establish, if both geometrically and structurally the new monolithic sleeper with modified geometry meets the required minimum mechanical requirements that are already met by the sleepers installed and in use. Apparently, this new monolithic sleeper with modified geometry penalises the internal forces in the central section of the sleeper, mainly in those cases where the sleeper is a dual gauge sleeper.

[0007] The object of the present invention is therefore to solve the problem of adapting the sleepers, already installed on tracks in service, to sleepers with different geometries depending on the required needs, such as noise reduction or reducing the flight of the ballast, by the development of a supplement or insert designed for this purpose. This supplement or insert is placed on those free surfaces of the sleeper, never changing the assembly zone on the sleeper of the fastenings of the track, that is, it is not the object of the present invention any supplement on the fastening zone.

[0008] Also, a standard sleeper that the solution incorporates, object of the present invention, will fulfil the European Standard EN 13230, referring to sleepers.

[0009] This solution opens the possibility of adapting the current models of standard sleepers, already installed and without any profile or specific geometry, to sleepers with a supplement which allow the achievement of new goals such as noise reduction or reduction of ballast flight. Against those already mentioned solutions of monolithic sleepers, thanks to the supplement object of the invention, the current solutions of standard sleepers that are already structurally optimised and tested for forces and momentum as well as the effectiveness of pre-stressing in the middle section, may continue to be used. The manufacture and supply is also possible of current standard sleepers with the supplement incorporated from the sleeper factory itself, where the supplement is incorporated once said sleeper is manufactured. It should be noted again that the supplement object of the present invention is not arranged in the zone of supports of the track on the sleeper where the fasteners are located. To install the supplement little effort is required to achieve the join that allows the bonding of the supplement on the sleeper in a simple manner from the construction point of view.

[0010] The advantage is most evident in the case of dual gauge sleepers because the internal forces (moments) in the central section are higher than in the standard sleepers, being more affected by the change of geometry in the case of opting for a monolithic solution.

[0011] The solution, object of the present invention, further allows for the protection and storage of all types of instrumentation needed in sections of existing tracks or on standard sleepers, prior to their installation, without modifying the structural characteristics of existing solu-
Also, noise reduction on the ballasted track, is usually made through baffles that absorb and prevent the transmission of noise, but in this case, the use of a supplement, preferably made from absorbent materials, contribute to noise reduction levels at the point of emission.

Finally, it should be mentioned that supplements in the fixings or fastenings of the rails to the sleepers, are known, but this is not the object of this invention, the present invention, as already mentioned, is centred on supplements to alter the geometry of the concrete sleepers which preferably are already installed. The supplements in the fixings do not affect in any way the geometry or functional aspects of the sleepers, these are used in the fixings already installed for gauge changes.

With reference to the current state of the art, it is noteworthy that, at least by the applicant, the existence of any supplement for concrete sleepers already installed, or invention of similar application or that has technical, structural and constitutive features similar to those presented by the supplement object of the present invention, is not known.

SUMMARY OF THE INVENTION

The supplement for railway sleepers that is the purpose of the present invention allows modifying the geometry of the upper surface of standard concrete sleepers installed for various purposes, for example, to change them into:

- a sleeper that minimises ballast flight due to its aerodynamic effect, to provide instrumentation protection of all types and/or,
- a sleeper for noise absorption through a supplement with a maximised surface and of a porous material.

In the first case, improving the aerodynamics of the sleeper, the supplement aims to:

- change the aerodynamic field near the sleeper, minimising the existing ballast flight, and
- prevent the ballast being placed on the sleeper, in this case on the supplement, due to the slightly curved shape of the upper surface of the supplement and also because it increases the distance between the surface level where the ballast is positioned and the upper surface of the sleeper as on this the supplement is situated.

Therefore, as mentioned, the proposed supplement involves an accessory element comprising one or more pieces of variable section whose lower base is adapted to the geometry of the top of the sleeper to which it is intended to be fastened or joined interdependently thereto by known fastening or connection means, these means can be mechanical or chemical, and preferably adhesive. An example of mechanical connection means could be, not limited to, headed reinforced steel bolts, while an example of chemical means could be, not limited to, polyurethane or epoxy adhesives. In any case, it should be noted that in the fastening or connection of the supplement on the sleeper there is no structural join or connection of both bodies to prevent a modification or change in the structural performance of the sleeper.

Structural features refer, as it will be explained later, to the mechanical features and mainly to the inertia of the sections. The connection means, by themselves or due to the structural features of the supplement joined to the sleeper do not involve the modification of the structural features of the sleeper, therefore maintaining the structural features of said sleeper unchanging, constant or invariable when compared with the structural features of the sleeper before connecting or fastening the supplement. A structural join is a connection that does not allow relative displacement between the connected or joined supplement and the sleeper, usually of concrete. For example, stiff connections, used in composite beams of steel structural profiles and concrete compression chords.

A first object of the present invention comprises the features included in claim 1. The supplement is joined interdependently by the lower surface through connection means to the sleeper so that the connection means, by themselves or due to the mechanical properties, low elastic or Young's modulus, of the supplement connected to the sleeper, maintain the structural features of the sleeper without involving the modification of the structural features, mainly inertia, of the sleeper.

A second object of the present invention, an assembly of sleeper and the supplement, is included in claim 12. The assembly of sleeper and supplement comprises the supplement object of the present invention joined to a sleeper through connection means.

The shape of the section and the material used to manufacture the supplement will depend on the end use to which it is intended, but preferably they will be materials with a Young's modulus lower than that of the concrete of the sleeper. For example, materials such as, but not limited to, could be polyamide or plastic. Preferably said Young's modulus of the material of the supplement will be less than 0.1 times the Young's modulus of concrete (E Material <0.1 Ec (concrete)) in order not to change the mechanical behaviour of the original sleeper, for example, but not limited to, recycled tyre with polyurethane, neoprene or rubber. Although the Young's modulus of the concrete is a well-known value and a person skilled in the art would know the same for a concrete sleeper, a reference modulus for a concrete sleeper would be in the range of 35000 Mpa.

For its part, said sleeper consists, preferably but without implying a limitation, of a standard sleeper, that is, the type consisting of an elongated piece comprising a central zone, two zones of support on each side of the central zone, on which the fastenings are located,
and two outer zones located at the ends of the sleeper, following on the support zones, being the upper surface of the central zone and the outer zones, preferably determined by adjoining flat areas with different inclinations, while the support zones have transverse grooves for holding the fasteners of the rails.

[0022] The geometry of the standard sleepers allows that the fixing system of the supplement to the sleeper can be done by mechanical means such as screws, because they have a pre-stressing tendon pattern with a central void that allows drilling, or also by chemical means, such as adhesives.

DESCRIPTION OF DRAWINGS

[0023] To complete the present description, and for the purpose of aiding in a better understanding of the characteristics of the invention, a set of drawings is attached, wherein, by way of illustration and not limitation, the following has been represented:

Figure 1 shows a schematic elevated side view of an example of dual gauge railway sleeper of international gauge to which has been incorporated the supplement object of the invention, according to an exemplary embodiment thereof consisting of three pieces, one central and two lateral. Figure 2 shows a plan view of the sleeper shown in Figure 1 with the supplement of the invention incorporated thereon. Figures numbers 3 and 4 show respective views in side elevation and top plan, respectively, of another example of high speed sleeper of UIC gauge with another example of supplement, according to the invention, incorporated thereon.

Figures numbers 5 and 6 show respective views also in side elevation and top plan, respectively, of a third example of three rail sleeper, with the supplement of the invention incorporated thereon, also in an exemplary embodiment thereof comprising three pieces, one central and two lateral. Figures 7a, 7b and 7c show different alternative sections according to the use of the supplement object of the present invention.

PREFERRED MODE OF CARRYING OUT THE INVENTION

[0024] In view of the aforementioned figures, the supplement (1) consists of an applicable element to be fixed interdependently to the upper part of a standard sleeper (2) with a lower surface and an outer surface, in particular a standard sleeper (2) comprising a central zone (2a), two support zones (2b) on each side of the central zone (2a), on which the rails are located, and two exterior zones (2c) located at the ends of the sleeper, following on from the support zones (2b), said supplement (1) comprising, at least one central piece (1a) of variable section whose lower surface (1') is complementary to the geometry of the upper surface (2') of the central zone (2a) of the sleeper (2) on which it is fixed tightly adapting to it. [0025] The outer surface of the supplement can have different geometries, shapes and textures according to the application. Additionally, the thickness of the supplement may be constant or variable, also according to the application.

[0026] For example, the supplement to improve the aerodynamics of the sleepers and minimise ballast flight must have a curved and smooth outer surface and be of an elastic material with a Young’s modulus less than 0.1 the Young’s modulus of the concrete of the sleeper. Furthermore, the supplement to reduce noise must have a porous texture on its surface and also a shape or geometry of said upper surface that maximises the noise absorptive surface reinforced by the porous material, being thereby provided with inlets and outlets. For example, a material that can be used is a concrete with a Young’s modulus lower than the Young’s modulus of the concrete of the sleeper.

[0027] Figures 7a, 7b and 7c show three alternative sections for a supplement according to the present invention, being Figures 7a and 7b, sections designed to absorb noise, with a maximised outer surface with inlets and outlets and of a porous material, for example concrete or an elastomer having a Young modulus lower than the concrete of the sleeper, and Figure 7c shows a section of a supplement to improve the aerodynamics of the sleeper, in which the upper surface of the supplement is curved and smooth, and its Young’s modulus is less than 0.1 times the Young’s modulus of the standard concrete sleeper to be modified.

[0028] Preferably the supplement (1) comprises three pieces, although it could only include one of them, that is, one central piece (1a) and two sides pieces (1b), being the central piece (1a) of variable section with a lower base (1') which is complementary to the geometry of the upper surface (2') of the central zone (2a) of the sleeper (2), and the two side pieces (1b) also of variable configuration but identical in both and different from that of the central piece (1a), and whose lower surfaces (1") are complementary to the geometry of the upper surface (2') of the exterior zones (2c) of the sleeper (2) on which they are fixed adapting tightly thereto.

[0029] Each of the central pieces (1a) and sides (1b) making up the supplement (1) join the corresponding upper surface of the central zone (2a) or exterior (2c) of the sleeper (2) by connection means that are not structural, that is, that do not involve the modification of the structural features of the standard sleeper, making both supplement and sleeper structurally independent. The join can be either mechanical or chemical through adhesives or other means of adhesion.

[0030] In particular, in the event that the supplement has a Young’s modulus lower than 0.1 times the Young’s modulus of the concrete of the sleeper, the join between the two can be rigid since the mechanical characteristics...
of the sleeper will not be modified, while if the supplement is rigid the join between the sleeper and the supplement must be flexible.

[0031] The supplement, object of the present invention, may be of any preferably deformable material in comparison to the concrete of the sleeper, such as plastic materials with a Young’s modulus less than the Young’s modulus of the concrete of the sleeper in order not to alter the tensions of the original standard sleeper installed and yet admit, in service, tensional deformations exceeding those of the concrete, therefore avoiding the structural union between both materials. Additionally, the material is chosen according to the final objective of the supplement to be installed. For example, if the objective is noise reduction, the material is porous, whereas if the objective is to reduce or eliminate the flight of ballast, the preferred material will preferably be compact in its surface.

[0032] With regard to the dimensions of the supplements, they will depend on the applications increasing the design possibilities being an additional supplement to the standard sleeper that does not affect the structural performance of the same, so that:

- the lengths of the supplement or supplements will depend on the lengths of the sleeper and the length of the existing spaces both between the fastenings of the sleeper and between the fastenings of the ends of said sleeper,
- the width of the supplement will that of the sleeper, and
- the height of the supplement can also be above the level of the fastenings its maximum height being the underneath of the train. The fact of raising the height of the supplement so that the height of the "sleeper-supplement" assembly is above the level of the fastening can both increase the outer surface of the supplement and therefore the absorption surface in those cases intended to minimise noise, as well as reduce the likelihood that ballast be placed on the supplement in those cases where it is intended to improve the aerodynamics of the sleeper.

[0033] This modification of the height of the sleeper is not possible to perform on the monolithic sleeper with modified geometry discussed above, since the existence of more concrete in the central part of the monolithic sleeper, to increase its height would prevent said sleeper from fulfilling the necessary requirements of the Standard in addition to requiring different designs and structural calculations to those of a sleeper with height below the level of the fastenings.

[0034] As to the design possibilities of the supplements, they are very varied because they do not have any structural function and do not alter at all said functions already proven of the standard sleepers. In fact, the supplements may even be asymmetric about the axis of symmetry of the sleeper parallel to the track layout, and depending on the location of the noise source and the layout of the track, for example with a greater height on one side of the supplement than on the other in order to adapt the modified standard sleeper to the noise source.

Claims

1. A supplement for concrete sleepers, applicable on the upper surface of a railway sleeper for modifying the geometry of said sleeper (2), characterised in that:

- it comprises a lower surface complementary to the geometry of the upper surface (2') of the sleeper and at least one outer surface, and
- the material of the supplement (1) has a Young’s modulus lower than the Young’s modulus of said concrete sleeper.

2. The supplement according to claim 1, characterized in that it is joined interdependently by the lower surface through connection means to the sleeper (2) so that the connection means, by themselves or due to the features of the supplement connected to the sleeper, maintain the structural features of the sleeper therefore not involving the modification of the structural features of the sleeper.

3. The supplement according to claim 1, wherein the Young’s modulus of the supplement is less than 0.1 times the Young’s modulus of the concrete of the sleeper.

4. The supplement according to claim 2 characterised in that the connection means are not structural avoiding structural join between the sleeper and the supplement.

5. The supplement according to claim 1 characterised in that it comprises at least one central piece which is positioned between the fasteners of a sleeper.

6. The supplement according to claim 1 characterised in that it comprises at least one side piece which is positioned between the attachment of a sleeper and the end of said sleeper.

7. The supplement according to claim 1 characterised in that the outer surface is a smooth curve.

8. The supplement according to claim 1 characterised in that the outer surface has inlets and outlets.

9. The supplement according to claims 3 and 4, characterised in that it comprises three pieces, one central (1 a) and two sides (1 b), the central piece (1 a) of variable section with a lower surface (1') comple-
mentary to the geometry of the upper surface (2') of the central zone (2a) of the sleeper (2) and the two side parts (1b) also of variable configuration both identical and different from that of the central piece (1 a), and whose lower surfaces (1') are complementary to the geometry of the upper surface (2') of the exterior zones (2c) of the sleeper (2) on which they are fixed adapting tightly thereto.

10. The supplement according to the previous claims characterised in that it is asymmetrical with respect to the axis of symmetry of the sleeper parallel to the track layout.

11. The supplement according to previous claims, characterised in that the height thereof, raises the height of the assembly formed by the sleeper and the supplement above the level of the fasteners used to fix the rails to the sleeper.

12. An assembly of sleeper and supplement characterised in that it comprises a supplement according to Claims 1 to 11.
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