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A MODULE TYPE COMB-SHAPED BRIDGE EXPANSION JOINT DEVICE FOR RESISTING A SUPER DISLOCATION

MODULAR ARTIGE KAMMFÖRMIGE BRÜCKENDEHNUNGSFUGENVORRICHTUNG ZUM WIDERSTEHEN VON EXTREMEN VERSchieBUNGEN

JOINT DE DILATATION MODULAIRE À DENTS POUR PONTS RÉSISTANT À UNE DISLOCATION IMPORTANT

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Description

Field of the Invention

[0001] The present invention relates to bridge expansion joint, in particular, to a large resisting distortion and modularized comb-type bridge expansion joint.

Background of the Invention

[0002] Among recent bridge expansion joints, a relatively good technique is the comb-type expansion joint, which comprises a fixed comb plate and a movable comb plate cooperating with each other, and it is especially applied in the large bridge expansion joint whose expansion amount is more than 160mm. For example, the Chinese patent No. ZL00264872.0 titled "Assemble Type Comb-type Bridge Expansion Joint" disclosed that invented by Bin Xu, the bridge expanding movement is provided by the movable comb plate which crosses on the bridge expansion, no lengthways transition space exists between the fixed comb plate and the movable comb plate, and the device connects the bridge surface and road surface as a whole, thereby, the ability to resist vibration is very good, and vehicles can drive smoothly and comfortably on the bridge without jumping.

[0003] However, with stayed-cable bridges, suspension bridges and arc-girder bridges, the girder will shift vertically or lengthways under the effect of vehicle loads or temperature. Besides, the girder will shift transversely or rotate under the effect of the wind and other forces. Then either the traditional modulus-type or the comb-type bridge expansion joint cannot meet the need for such shift. The modulus-type joint will cause the lengthways girder and transverse girder to separate from each other and make the supporting seat broken. And in the case of the comb-type bridge expansion joint, since the comb teeth touch rigidly with each other, under such transverse shift, the comb teeth are easily broken, and the whole expansion joint damaged.

[0004] Also known in the prior art is US6609265 which discloses a structure in which there is a rotatable joint between the root of the movable comb plate and the seat. The structure of the rotatable joint is very different from the present invention and does not enable balanced rotation.

Summary of the Invention

[0005] It is an object of the present invention to provide a large resisting distortion and modularized comb-type bridge expansion joint whose girders can still be whole and not be broken when its girders have large transverse shift or rotation under the effect of the wind and other forces.

[0006] The another object of the present invention to provide a large resisting distortion and modularized comb-type bridge expansion joint which can not only resist the transverse shift of the girders but also resist the vertical shift of the girders.

[0007] According to the present invention there is provided a large resisting distortion and modularized comb-type bridge expansion joint comprising a seat and an underlay fixable on girders:

characterised in that the rotatable joint between the root of said movable comb plate and said seat comprises:

- a columnar rotating shaft projecting downwards fixed at the bottom of the root of said movable comb plate; said seat having a corresponding columnar groove; said columnar rotating shaft and said columnar groove being joined together by fixing bolts; holes for said fixing bolts on said seat being kidney-shaped, and being filled with resilient damp material around said fixing bolts.

- preferably a resilient supporting seat is padded at the bottom of said columnar groove.

- preferably said fixing bolts go through said movable comb plate and said seat, and the tail step of said fixing bolts and/or surface of the nut are is of spherical shape, while said seat and/or said movable comb plate have/has a corresponding spherical-shaped groove at their corresponding place.

- preferably the comb teeth are rotatably joined with the root of said fixed comb plate by a pilot pin which goes through the comb teeth and the root of said fixed comb plate.

- preferably the comb teeth of said fixed comb plate join with said underlay by a pilot pin which goes through the comb teeth of said fixed comb plate and said underlay, the hole for the pilot pin on the underlay is kidney-shaped, and a resilient damp material is filled in the space around said pilot pin, whereby the comb teeth can shift transversely relative to said underlay.

- preferably a safe spring connects the root of...
Preferably a safe bolt connects the root of said movable comb plate and said seat.\[0013\] Compared with the prior art, in this invention, when the girders have transverse shift under the effect of the wind or other external forces, the movable comb plate and its comb teeth will rotate correspondingly and the comb teeth of the fixed comb plate will also rotate correspondingly, and under the effect of the resilient damp material, the forces from flexibility distortion can efficaciously be weakened and the vibration of vehicles can be reduced. Therefore, the wearing out and the damage of the expansion joint will both be mitigated, and the broken of the comb teeth can be avoided. At the same time, the design of the spherical-shaped bolt’s surface, the resilient supporting seats, the safe spring, the safe bolt and the special design for vertical rotation, all can further be fit for the vertical shift of the girders, therefore, the whole expansion joint can be fit for the multi-directional shift of the girders, avoid be broken rigidly, and further improve the ability of resisting the wearing out and the damage of the expansion joint, and to extend the time of usage of the expansion joint; While the design of modulation makes the building and maintenance easy, and reduces the fee of manufacture and maintenance.

Briefer Description of the Drawings

\[0015\] FIG.1 is a perspective view of the expansion joint of the first embodiment of the present invention.
FIG.2 is the sectional view of A-A way of FIG.1.
FIG.3 is the zooming in view of the sectional view of B-B way of FIG.1.
FIG.4 is the zooming in view of part of FIG2.
FIG.5 is the sectional view of C-C way of FIG4.
FIG.6 is the zooming in view of another part of FIG.2.
FIG.7 is the sectional view of D-D way of FIG.6.
FIG.8 is the sectional view of E-E way of FIG.6.
FIG.9 is a perspective view of E-E way of FIG.6.
FIG.10 is a perspective view of the expansion joint of the second embodiment of the present invention.
FIG.11 is the sectional view of F-F way of FIG.10.
FIG.12 is the zooming in view of the sectional view of G-G way of FIG. 10.
FIG.13 is the zooming in view of part of FIG.11.
FIG.14 is the sectional view of H-H way of FIG.13.
FIG.15 is a perspective view of the expansion joint of the third embodiment of the present invention.
FIG.16 is the sectional view of I-I way of FIG.15.
FIG.17 is the zooming in view of part of FIG. 16.
FIG.18 is the zooming in view of the sectional view of J-J way of FIG.15.

To enable a further understanding of the innovative and technological content of the invention herein, refer to the detailed description of the invention and the accompanying drawings below:

\[0016\] FIGS.1-9 show the first embodiment of the present invention applied to steel girder. In this embodiment, the large resisting distortion and modularized comb-type bridge expansion joint comprises several modules which locate in parallel in the direction of a bridge's width, and each module includes a fixed comb plate 2 and a movable comb plate 1 which are respectively disposed on girders located at the two sides of the bridge expansion joint, the movable comb plate 1 crosses over the bridge expansion joint, both of the fixed comb plate 2 and the movable comb plate 1 have a plurality of comb teeth 22, 11 at their opposite ends, and the comb teeth 11 of the movable comb plate 1 interdigitate with the comb teeth 22 of the fixed comb plate 2, as shown in FIG.1 and FIG.2.

\[0018\] The root of said movable comb plate 1 rotatably joins with a seat 5 fixed on the girder. A columnar rotating shaft 12 projecting downwards is fixed at the bottom of the root of the movable comb plate 1, the seat 5 has a corresponding columnar groove 51 at the bottom of which a resilient supporting seat 52 is padded, while the columnar rotating shaft 12 and the columnar groove 51 joint together by fixing bolts 4 at the border part of them, (the amount of the fixing bolts 4 can accord to actual situation, only one fixing bolts 4 can also work), further more, the hole 51 for the fixing bolts 4 on the seat 5 is in kidney-shape, and resilient damp material 53 is filled in the space around the fixing bolts 4, as shown in FIG.3. FIG.4, FIG.5. A safe bolt 3 connects the root of the movable comb plate 1 and the seat 5, and the safe bolt 3 goes through the seat 5 and the movable comb plate 1 from the bottom of the seat 5 to the top of the movable comb plate 1, while, the corresponding hole on the movable comb plate 1 is in step shape, in that hole, there set a compressed spring 31 which ring on the part of the safe bolt 3 above the step of the hole, and the compressed spring is restricted by a nut, as shown in FIG.4.

\[0019\] To resist a certain of the vertical shift of girders, the tail step of the fixing bolts 4 and surface of the nut are in spherical shape, while the seat 5 and the movable comb plate 1 have a corresponding spherical-shaped groove at their corresponding place, as shown in FIG.4.

\[0020\] Said fixed comb plate 2 is movably set on an underlay 6 fixed on the girder and the comb teeth 22 rotatably joins with the root of the fixed comb plate 2 by a pilot pin 23 which goes through the comb teeth 22 and the root of the fixed comb plate 2, as shown in FIG. 6, FIG.7, and FIG.8.

\[0021\] When the girders shift transversely and rotate...
under the external forces, the movable comb plate of every module will correspondingly rotate in a certain of angle around the root of comb teeth, and make the comb teeth of the fixed comb plate shift transversely in a certain distance, to avoid the broken of the comb teeth, as shown in FIG.9.

[0022] Fig.10–14 show the second embodiment of the present invention. The difference of this embodiment compared with the first embodiment is the form of the root of said movable comb plate 1 rotateably jointing with the seat 5. In this embodiment, a columnar rotating shaft 12 projecting downwards is fixed at the bottom of the root of the movable comb plate 1, and a similar columnar pin 13 is set projecting downwards adjacent to the columnar rotating shaft 12, while the seat 5 correspondingly has a columnar groove 51 on the bottom of which a resilient supporting seat 52 is padded, and the supporting seat 83 and the seat 5 joint together by a fixing bolts 9 at the border part of them, in the meanwhile, the hole 53 for the fixing bolts 9 on the seat 5 is in kidney-shape, resilient damp material 91 is filled in the space around the fixing bolts 9.

[0023] To resist a certain of the vertical shift of girders, the tail step of the central bolt 7 and/or surface of the nut are/is in spherical shape, while the seat 5 and the movable comb plate 1 have a corresponding spherical-shaped groove at their corresponding place, as shown in FIG.12 and FIG.13.

[0024] Another difference of this embodiment compared with the first embodiment is: in this embodiment, a safe spring 32 connects the root of the movable comb plate 1 and the seat 5 instead of the safe bolt 3, as shown in FIG.13.

[0025] FIGS.15–20 show the third embodiment of the present invention. The difference of this embodiment compared with the first and second embodiment is the form of the root of said movable comb plate 1 rotateably jointing with the seat 5. In this embodiment, the form in fact combines the structure disclosed in the Chinese patent No. CN200410049491.5 titled "Large Resisting Distortion Comb-type Bridge Expansion Joint" invented by Bin Xu, and the ability to resist the vertical shift of the girders is further improved. The form is as bellow: The root of the movable comb plate 1 is in comb-shape, and the movable comb plate 1 has a rotating shaft 14 fixed on its undersurface, and in the comb-shaped space of the root of the movable comb plate 1, there set a shaft seat which comprises a pressing seat 82 and a supporting seat 83, while, the pressing seat 82 and the supporting seat 83 are fixed together by a bolt 81, and the pressing seat 82 has a half-columnar groove on its undersurface, and the supporting seat 83 also has a half-columnar groove on its top surface, therefore, the rotating shaft 14 is hold by said shaft seat, further more, the supporting seat 83 has a columnar rotating shaft 83a projecting downwards, and the seat 5 has a corresponding columnar groove 51 on the bottom of which a resilient supporting seat 52 is padded, and the supporting seat 83 and the seat 5 joint together by fixing bolts 9 at the border part of them, in the meanwhile, the hole 53 for the fixing bolts 9 on the seat 5 is in kidney-shape, resilient damp material 91 is filled in the space around the fixing bolts 9.

Claims

1. A large resisting distortion and modularized comb-type bridge expansion joint comprising a seat (5) and an underlay (6) fixable on girders:

   a) at least two modules locatable in parallel in the direction of the bridge’s width;
   b) each said module including a fixed comb plate (2) and a movable comb plate (1), which are respectively suitable for being disposed on girders located at the two sides of the bridge expansion joint, said movable comb plate (1) crossing over the bridge expansion joint;
   c) both of said fixed comb plate (2) and said movable comb plate (1) having a plurality of comb teeth (22), (11) at their opposite ends, and the comb teeth (11) of said movable comb plate (1) interdigitating with the comb teeth (22) of said fixed comb plate (2); wherein

   the root of said movable comb plate (1) rotatably joins said seat (5) fixable on the girder;
   the comb teeth (22) of said fixed comb plate (2) rotatably joins with the root of said fixed comb plate (2), while, the middle of the comb teeth (22) of said fixed comb plate (2) is movably set on the underlay (6) fixable on the girder, and can be shifted transversely relative to the underlay (6),

characterised in that the rotatable joint between the root of said movable comb plate (1) and said seat (5) comprises:

a) a columnar rotating shaft (12) projecting downwards fixed at the bottom of the root of said movable comb plate (1);
   b) said seat (5) having a corresponding columnar groove (51);
   c) said columnar rotating shaft (12) and said columnar groove (51) being joined together by fixing bolts (4);
   d) holes (53) for said fixing bolts (4) on said seat (5) being kidney-shaped, and being filled with resilient damp material (41) around said fixing bolts (4).

2. The large resisting distortion and modularized comb-type bridge expansion joint of claim 1, wherein a resilient supporting seat (52) is padded at the bottom
of said columnar groove (51).

3. The large resisting distortion and modularized comb-type bridge expansion joint of claim 1, wherein said fixing bolts (4) go through said movable comb plate (1) and said seat (5), and the tail step of said fixing bolts (4) and/or surface of the nut are is of spherical shape, while said seat (5) and/or said movable comb plate (1) have has a corresponding spherical-shaped groove at their corresponding place.

4. The large resisting distortion and modularized comb-type bridge expansion joint of one of claim 1 to claim 3, wherein the comb teeth (22) rotatably joined with the root of said fixed comb plate (2) by a pilot pin (23) which goes through the comb teeth (22) and the root of said fixed comb plate (2).

5. The large resisting distortion and modularized comb-type bridge expansion joint of one of claim 1 to claim 3, wherein the comb teeth (22) of said fixed comb plate (2) join with said underlay (6) by a pilot pin (21) which goes through the comb teeth (22) of said fixed comb plate (2) and said underlay (6), the hole (61) for the pilot pin (21) on the underlay (6) is kidney-shaped, and a resilient damp material (62) is filled in the space around said pilot pin (21), whereby the comb teeth (22) can shift transversely relative to said underlay (6).

6. The large resisting distortion and modularized comb-type bridge expansion joint of one of claim 1 to claim 3, wherein a safety spring (32) connects the root of said movable comb plate (1) and said seat (5).

7. The large resisting distortion and modularized comb-type bridge expansion joint of one of claim 1 to claim 3, wherein a safety bolt (3) connects the root of said movable comb plate (1) and said seat (5) through a compressed spring (31) which makes the connection a movable connection.

**Patentansprüche**

1. Große verzerrungsbeständige und modulartige kammförmige Brückendehnungsfuge, die eine Auflage (5) und eine Unterlage (6) aufweist, die an Unterzügen befestigt werden kann; mindestens zwei Module, die parallel in Richtung der Breite der Brücke angeordnet werden können; wobei ein jeder Modul eine stationäre Kammmatte (22) und eine bewegliche Kammmatte (11) umfasst, die jeweils dafür geeignet sind, dass sie auf Unterzügen angeordnet werden, die auf den zwei Seiten der Brückendehnungsfuge angeordnet sind, wobei die bewegliche Kammmatte (1) die Brückendehnungsfuge überkreuzt; wobei sowohl die stationäre Kammmatte (2) als auch die bewegliche Kammmatte (1) eine Vielzahl von Kammmählen (22), (11) an ihren entgegengesetzten Enden aufweisen, und wobei die Kammmählen (11) der beweglichen Kammmatte (1) mit den Kammmählen (22) der stationären Kammmatte (2) fingerartig ineinander greifen; wobei sich der Fuß der beweglichen Kammmatte (1) drehbar mit der Auflage (5) verbindet, die am Unterzug befestigt werden kann; wobei sich die Kammmählen (22) der stationären Kammmatte (2) drehbar mit dem Fuß der stationären Kammmatte (2) verbinden, während die Mitte der Kammmählen (22) der stationären Kammmatte (2) beweglich auf der Unterlage (6) eingerichtet wird, die am Unterzug befestigt werden kann, und quer relativ zur Unterlage (6) verschoben werden kann, dadurch gekennzeichnet, dass die drehbare Verbindung zwischen dem Fuß der beweglichen Kammmatte (1) und der Auflage (5) aufweist:

2. Große verzerrungsbeständige und modulartige kammförmige Brückendehnungsfuge nach Anspruch 1, bei der eine elastische stützende Auflage (52) am Boden der säulenartigen Nut (51) untergelegt ist.

3. Große verzerrungsbeständige und modulartige kammförmige Brückendehnungsfuge nach Anspruch 1, bei der die Befestigungsschrauben (4) durch die beweglichen Kammmatten (1) und die Auflage (5) hindurchgehen, und wobei der hintere Absatz der Befestigungsschrauben (4) und/oder die Oberfläche der Mutter von einer kugelartigen Form ist/sind, während die Auflage (5) und/oder die bewegliche Kammmatte (1) eine entsprechende kugelförmige Nut an ihrer entsprechenden Stelle aufweist/ aufweisen.

4. Große verzerrungsbeständige und modulartige kammförmige Brückendehnungsfuge nach einem der Ansprüche 1 bis 3, bei der die Kammmählen (22) drehbar mit dem Fuß der stationären Kammmatte
1. Grand joint de dilatation modulaire de pont du type à peigne résistant à une déformation, comprenant un siège (5) et un support (6) pouvant être fixé sur des poutres ; au moins deux modules, pouvant être positionnés de manière parallèle à la largeur du pont ; chaque dit module englobant une plaque à peigne mobile (1) comportant plusieurs dents de peigne (22) (11) au niveau de leurs extrémités opposées, les dents de peigne (11) de ladite plaque à peigne mobile (1) s'engrenant dans les dents de peigne (22) de ladite plaque à peigne fixe (2) ; dans lequel la base de ladite plaque à peigne mobile (1) est reliée de manière rotative audit siège (5) pouvant être fixé sur la poutre ; les dents de peigne (22) de ladite plaque à peigne fixe (2) étant reliées de manière rotative à la base de ladite plaque à peigne fixe (2) (22) de ladite plaque à peigne fixe (2) étant ajustées de manière mobile sur le support (6) pouvant être fixé sur la poutre, et pouvant être déplacées transversalement par rapport au support (6) ; caractérisé en ce que le joint rotatif entre la base de ladite plaque à peigne mobile (1) et ledit siège (5) comprend :

un arbre rotatif en forme de colonne (12), débordant vers le bas, fixé sur la partie inférieure de la base de ladite plaque à peigne mobile (1) ;
ledit siège (5) comportant une rainure en forme de colonne correspondante (51) ;
ledit arbre rotatif en forme de colonne (12) et ladite rainure en forme de colonne (51) étant reliés par des boulons de fixation (4) ;
des trous (53) pour lesdits boulons de fixation (4) sur ledit siège (5) étant réniformes et étant remplis d’un matériau d’amortissement élastique (41) autour desdits boulons de fixation (4) ;
(21), lesdites dents de peigne (22) pouvant ainsi être déplacées transversalement par rapport audit support (6).

6. Grand joint de dilatation modulaire de pont du type peigne résistant à une déformation selon l’une des revendications 1 à 3, dans lequel un ressort de sécurité (32) assure la connexion de ladite plaque à peigne mobile (1) et dudit siège (5).

7. Grand joint de dilatation modulaire de pont du type peigne résistant à une déformation selon l’une des revendications 1 à 3, dans lequel un boulon de sécurité (3) assure la connexion de la base de ladite plaque à peigne mobile (1) et dudit siège (5) par l’intermédiaire d’un ressort comprimé (31), transformant la connexion en une connexion mobile.
REFERENCES CITED IN THE DESCRIPTION

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