

Device for suspending a rail, in particular a rail of an overhead conveyor or a lifting gear

The invention relates to a suspension device for a rail, in particular a rail of an overhead conveyor or a lifting gear, having a tensile element which includes a threaded rod and at least one connection part screwed thereto, and having a securing element which prevents the screw connection between the threaded rod and the connection part from being loosened.

A suspension for a crane rail on a supporting mechanism in the form of a cover or a cover profile is known from German patent document DE 10 2005 040 421 B4. A crane can travel along the crane rail via travelling mechanisms. The crane rail is attached to the supporting mechanism via several suspensions spaced apart from each other in the longitudinal direction of the crane rail. Each of the suspensions consists essentially of an upper attachment part having a first threaded sleeve, a threaded rod and a lower attachment part having a second threaded sleeve. The upper attachment part is attached to the supporting mechanism and the lower attachment part is attached to the rail to be suspended. The lower attachment part is suspended on the upper attachment part via the threaded rod whose opposite ends are screwed into the first threaded sleeve and second threaded sleeve. By using a threaded rod in conjunction with the threaded sleeves, the vertical length of the complete suspension can easily be adapted to the local conditions in order to thus suspend the crane rail in the desired orientation and to distribute the load on the suspensions. In order to protect the connection between the threaded rod and the lower attachment part and the upper attachment part against unscrewing, a spring connector is provided in each case and comprises a pin part and a spring part. For this purpose, the pin part is inserted through a through-going elongate mounting hole in the respective threaded sleeve and a through-going elongate mounting hole in the threaded rod, whilst the spring part lies against the respective threaded sleeve on the outside. The pin part is thus prevented from sliding out of the elongate mounting holes. These suspensions are also configured to swing since this ensures that the crane rails are oriented automatically or come into the condition of equilibrium, i.e., there is no substantial bending load in the tensile element. The swinging suspension is effected via



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ball-and-socket joint bearings.

So-called turnbuckles are known from the German utility model DE 299 14 578 U1 and from the German laid-open document DE 101 31 183 A1 and are also used for the
5 suspension of rails of overhead monorails in the mining industry. These turnbuckles consist essentially of a central turnbuckle sleeve and two tensioning eyelets laterally connected thereto. The tensioning eyelets each consist of an eyelet to accommodate hooks, bolts or cables, and a shaft, disposed on the eyelet, having an outer thread. The
10 turnbuckle sleeve is formed either as an elongate frame or as a sleeve, on the opposite ends of which are disposed inner threads in the form of nuts. The shafts of the tensioning eyelets are screwed into these nuts. The outer thread of the shafts run in opposite directions which means that the eyelets of the tensioning eyelets can be moved towards each other or away from each other by rotating the turnbuckle sleeve relative to the two
15 tensioning eyelets. In the case of one of the two turnbuckles, provision is also made that the two tensioning eyelets can be blocked with respect to the turnbuckle sleeve. For this purpose, several grooves are disposed in the shafts which extend in each case in the longitudinal direction of the shafts. Mounted on the tensioning eyelets is in each case a resiliently biased pin which can be moved from a pulled-back rest position into a
20 blocking position to block the turnbuckle, the pin protruding into one of the grooves in this blocking position. Such turnbuckles are fundamentally different from the design of the previously described suspension devices since these do not comprise a central threaded rod but rather only two tensioning eyelets having threaded shafts.

The object of the present invention is to provide a suspension device for a rail, in
25 particular a running rail of an overhead conveyor or a lifting gear, which allows simplified and secure assembly.

This object is achieved by a suspension device having the features of Claim 1.

Advantageous embodiments of the suspension device are provided in subordinate Claims
30 2 to 8.

In accordance with the invention, in the case of a suspension device for a rail, in particular a rail of an overhead conveyor or a lifting gear, having a tensile element which includes a threaded rod and at least one connection part screwed thereto, and having a securing element which prevents the screw connection between the threaded rod and the connection part from being loosened, simplified and secure assembly is achieved by virtue of the fact that the securing element engages with a pin part into a groove in the assembled state, said groove being disposed in the threaded rod. The groove in the threaded rod results in considerably simpler assembly since the securing element can be easily inserted after the groove has been aligned flush with the opening, without a bore in the threaded rod and/or the connection part having to be provided. There is no need for any length-dependent mechanical working during assembly. The groove results only in a small reduction in cross-section in the threaded rod and barely reduces its strength.

In terms of the invention, a threaded rod is understood to mean a bar having an outer thread which has no specially shaped surfaces or regions for engaging a tool, such as for example a hexagonal head. The outer thread is provided at least in the region of the opposite ends of the threaded rod but typically extends over the entire length of the threaded rod. The outer thread also has just one pitch direction. Since the threaded rod is simply designed in this manner, it is particularly suitable for use in the suspension device since the length of the threaded rod to be used can frequently only be determined on site when suspending the rails. A threaded rod can then be simply shortened to the required length on site. The threaded rods can thus be produced in an advantageous manner in graded standard lengths. An appropriate simple length adjustment can not be effected in the case of turnbuckles since the lengths of the shafts of the tensioning eyelets are adapted to the length of the turnbuckle sleeve.

The securing element acts and is supported in a reliable manner by virtue of the fact that the securing element engages into the groove with the pin part through an opening in the connection part in the assembled state.

From a manufacturing point of view, it has proven to be convenient for the groove to

extend in the longitudinal direction of the threaded rod.

Shortening the threaded rods and also procuring the threaded rods is facilitated by virtue of the fact that the groove extends in the longitudinal direction of the complete threaded
5 rod.

In a preferred embodiment, provision is made that the securing element is formed in the manner of a two-spring connector having two opposing limbs. In this case, the pin part is shortened compared with a commercially available two-spring connector, since it only
10 has to be inserted into the groove in the assembled state. The securing element is thus formed in a manner allowing it to be produced simply and the sleeve-shaped connection parts only need to be provided with the bores for use of the two-spring connector and do not have to be subjected to any additional, costly, mechanical working.

15 The pin part is secured in the groove via the limbs of the two-spring connector which, in the assembled state of the securing element, engage behind the sleeve-shaped connection part, as seen in the direction of the pin part.

In a particularly advantageous manner, provision is made that the opening is formed as an
20 elongate hole, whose longitudinal extension is oriented in the longitudinal direction of the threaded rod, and the pin part is formed in a u-shaped manner such that a plane spanned by the pin limbs is oriented at right angles to a plane spanned by the limbs of the securing element and includes the longitudinal axis of the threaded rod. In other words, the pin part is formed in a u-shaped manner as seen transversely with respect to its insertion
25 direction and as seen transversely with respect to the longitudinal direction of the threaded rod. The securing element, in particular its pin part, is hereby prevented from being able to rotate in the opening and in the groove. Therefore, the limbs also do not slide down from the threaded sleeve portion even when there is a mechanical influence from the outside.

30 In a preferred embodiment, provision is made that the tensile element includes, in

addition to the threaded rod, a lower connection part and an upper connection part.

In a typical usage mode, in the assembled state the rail is suspended on the lower connection part and the upper connection part is attached to a supporting element.

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Further features, details and advantages of the invention are provided in the subordinate claims and the following description of exemplified embodiments using the drawing, in which:

- 10 Figure 1 shows a perspective view of a single girder suspension crane,
- Figure 2 shows an enlarged portion of the region Z of Figure 1,
- Figure 3 shows an enlarged portion of Figure 2, taken from the region of a securing element in the manner of a two-spring connector,
- Figure 4 shows a sectional view of Figure 3,
- 15 Figure 5 shows a perspective view of the securing element of Figure 3,
- Figure 6 shows a front view of the securing element of Figure 5.

- Figure 1 shows a plurality of suspension devices 1 in conjunction with a single girder suspension crane. By means of the suspension devices 1, rails 2, which extend
- 20 substantially horizontally and are profiled in a downwardly open c-shape, are suspended on supporting elements 3 or further rails 2. The supporting elements 3 are formed as I-beams. Since the present exemplified embodiment relates to a single girder suspension crane, two first rails 2a, which extend in a substantially horizontal manner in parallel with and at a spaced disposition with respect to each other, are provided and are used as
- 25 running rails of the single girder suspension crane, and a second rail 2b, which forms a crane rail, which is oriented substantially transversely with respect to the first rails 2a and can travel along the first rails 2a. For this purpose, the second rail 2b is suspended via two suspension devices 1 in each case on a travelling mechanism which is not shown and can travel along the first rails 2a. A lifting gear 4 such as a chain or cable hoist is
- 30 generally suspended on the second rail 2b and can travel along the second rail 2b by means of a further travelling mechanism, not shown. The lifting gear 4 can be controlled

by a pendant switch 5 suspended on the lifting gear 4.

Figure 2 shows an enlarged portion of the region Z of Figure 1 which relates to a suspension device 1. The suspension device 1 consists essentially of a lower attachment part 6, a tensile element 7 and an upper attachment part 8. The rail 2a is suspended on the tensile element 7 of the suspension device 1 by means of the lower attachment part 6. The tensile element 7 is attached to the supporting element 3, which is formed in this case as a concrete slab, via the upper attachment part 8. In order to be able to provide the rail, which is C-shaped and open at the bottom, with suspension devices 1 at any location in its longitudinal direction, it comprises in the upper region an upwardly protruding web 2c extending in the longitudinal direction of the rail 2a, which web extends away from the rail 2a and thus upwards in a v-shaped manner. The lower attachment part 6 is formed in a clamp-like manner and engages around the upwardly widening web 2c. The tensile element 7 is attached to the upper end of the lower attachment part 6 opposite the web 2c. Depending upon the local conditions and the manner of using the rail 2a, this attachment can be formed in a rigid or swinging manner. A rigid connection can be effected for example via a corresponding screw connection; a swinging connection can be provided via a ball coupling in the region of the end of the tensile element 7 and a corresponding receptacle in the region of the lower attachment part 6.

The rod-shaped tensile element 7 includes a lower connection part 7a, a threaded rod 7b and an upper connection part 7c. The lower and upper connection parts 7a, 7c are formed substantially as threaded sleeves 7d at their end facing the threaded rod 7b and are provided at their opposite ends for example with an outer thread in the case of a rigid attachment or with a half-ball coupling part 7e (see Figure 3) for the articulated connection to the lower attachment part 6 or upper attachment part 8. Designing the tensile element 7 with a threaded rod 7b is advantageous in that depending upon the local conditions the threaded rods 7b can be shortened to the desired suspension length and then assembled into the required length by screwing the lower connection part 7a and the upper connection part 7c to the tensile element 7. In order to secure the screw connection between the lower connection part 7a and the threaded rod 7b as well as the upper

connection part 7c and the threaded rod 7b, an upper securing element 9b and a lower securing element 9a are provided. The lower and upper securing elements 9a, 9b are formed in each case in the manner of a two-spring connector.

- 5 Figure 3 shows an enlarged view of an upper connection part 7c which is engaged with a threaded rod 7b and is secured via an upper securing element 9b. The upper connection part 7c is divided into a lower threaded sleeve portion 7d and an upper half-ball coupling part 7e. The half-ball coupling part 7e and the threaded sleeve portion 7d are formed in one piece and the curved surface of the half-ball coupling part 7e faces the threaded sleeve portion 7d. The half-ball coupling part 7e is part of a ball-and-socket joint bearing whose complementarily formed reception shell is disposed in the upper attachment part 8 of the suspension device 1. The threaded sleeve portion 7d is provided with an inner thread, into which the upper end of the threaded rod 7b is screwed with its outer thread. In order to secure the threaded rod 7b in the threaded sleeve portion 7d, the wall of the threaded sleeve portion 7d is provided with a opening 10, into which a pin part 9c of the upper securing element 9b can be inserted. The opening 10 passes through the wall of the threaded sleeve 7d which means that the pin part 9c of the upper securing element 9b impinges upon the outer periphery of the threaded rod 7b. Furthermore, the threaded rod 7b comprises a groove 11 extending in its longitudinal direction L, wherein the pin part 9c of the upper securing element can be inserted into this groove. The threaded rod 7b and the upper connection part 7c are hereby effectively prevented from rotating with respect to each other.

- It can also be seen that, in a configuration typical for a two-spring connector, the pin part 9c becomes two helical regions 9d disposed in a symmetrical manner with respect to each other, and is formed in this case to increase the spring force as a double coil having two windings. Each of the two helical regions 9d becomes a limb 9e, as seen starting from the pin part 9c, which limb abuts against the peripheral surface 7f of the cylinder-shaped threaded sleeve portion 7d from the outside when the upper securing element 9b is in the assembled state. As seen from the helical region 9d, each of the limbs 9e becomes a curved region 9f, wherein the curved region 9f follows the peripheral surface 7f of the

threaded sleeve portion 7d and then curves inwards. Since the curved region 9f lies against the peripheral surface 7f of the threaded sleeve portion 7d in the region of approximately one eighth of the periphery of the threaded sleeve portion 7d and, as seen from the direction of the pin part 9e, resiliently engages behind the threaded sleeve

5 portion 7d and the two curved regions 9f form a counter-bearing for the pin part 9c inserted in its longitudinal direction into the opening 10 and groove 11 and thus in the radial direction of the threaded rod 7b. The longitudinal extensions of the pin part 9c and the limb 9e extend substantially in parallel with and at a spaced disposition with respect to each other. It can also be seen from Figure 3 that the pin part 9c is formed as a whole

10 in a U-shaped manner since there follows two helical regions 9d each in the manner of a two-spring connector.

The above description also applies to the identically formed lower connection part 7a and the associated lower securing element 9a.

Figure 4 illustrates a sectional view of Figure 3, taken from the region of the threaded sleeve 7d with a threaded rod 7b also screwed-in. It can be seen that the pin part 9c protrudes through the opening 10 in the threaded sleeve portion 7d into the groove 11 in the threaded rod 7b. Only a single groove 11 is provided in the threaded rod 7b. It would

20 also be fundamentally possible to provide several grooves in order to achieve a more precise adjustment of the length of the tensile element 7. However, practice has shown that one groove 11 is sufficient since length adjustments of the tensile element 7 in the millimetre range are already possible using this one groove. Figure 4 also shows that the limb 9e of the upper securing element 9b in a curved region 9f follows the contour of the

25 peripheral surface 7f of the threaded sleeve portion 7d. This curved region 9f is then followed by an approximately 90° bend outwards which issues into an opening region 9g. By way of these two opening regions 9g, extending in opposite directions, it is easier to fit the securing element onto the threaded sleeve portion 7d against the spring force of the helical regions 9d.

The securing element 9 is also dimensioned such that it can be fitted onto the threaded

sleeve portion 7d laterally and in this case the pin part 9c then already protrudes into the opening 10 but not yet into the groove 11, since this is not yet aligned with the opening 10. Upon rotation of the threaded rod 7b relative to the threaded sleeve portion 7d, the result - when the groove 11 is aligned with the opening 10 - is that the pin part 9c slides automatically into the groove 11 by reason of the spring force of the securing element 9. This is a great advantage during assembly and reduces the assembly time.

Figure 5 shows a perspective view of a lower or upper securing element 9a, 9b. The u-shaped formation of the pin part 9c can be seen particularly clearly in this view. In a corresponding manner, the opening 10 in the threaded sleeve 7d is not formed as a circular bore but rather as an elongate hole. The u-shaped region of the pin part 9c thus comprises a web part 9i, which in the assembled state rests in the base of the groove 11, and respectively opposing lower and upper web limbs 9h and 9j adjoining thereto and extending in a substantially mutually parallel manner.

It is also fundamentally possible for the opening 10 to adjoin the edge facing the threaded rod 7b and thus to have only the form of a recess open in the direction of the threaded rod 7b.

Figure 6 shows a view from Figure 5 in the direction of the free end of the pin part 9c. It can be seen in particular that the doubled helical regions 9d are to be wound starting from the U-shaped pin part 9c from the top or bottom inwardly and towards each other so that despite the doubled helical regions 9d, the limbs 9e which are oppositely arranged in relation to the threaded sleeve portion 7d, lie in a plane and thus the pin part 9e is securely held in the opening 10 and groove 11. It can also be seen that the pin part 9c is formed to be shorter than a commercially available two-spring connector since it is inserted only into a groove 11 and does not have to be inserted through the through-going bore - otherwise typically provided - in the threaded rod.

In this exemplified embodiment, the suspension device 1 is described in conjunction with a single girder suspension crane. Of course, this new suspension device 1 is also suitable

for suspending rails 2, 2a, 2b of double girder suspension cranes and monorails as well as rails 2, 2a, 2b on which travelling mechanisms of overhead conveyors or lifting gears can travel. The securing element is also described as a two-spring connector. It is by all means possible also to form this as a single spring connector. Typically, the threaded rod 5 7b has an outer thread over its entire length. It is also feasible for the threaded rod 7b to have an outer thread only at its opposite end regions. Of course, it is also feasible to provide, in addition to the single groove 11, a second groove 11 opposite thereto. Third and fourth grooves distributed evenly over the periphery are also feasible. Increasing the number of grooves 11 means that the effective length of the threaded rod 7b can be 10 adjusted in a more precise manner.

List of reference numerals

	1	Suspension device
	2	Rail
5	2a	First rails
	2b	Second rails
	2c	Web
	3	Supporting element
	4	Lifting gear
10	5	Pendant switch
	6	Lower attachment part
	7	Tensile element
	7a	Lower connection part
	7b	Threaded rod
15	7c	Upper connection part
	7d	Threaded sleeve portion
	7e	Half-ball coupling part
	7f	Peripheral surface
	8	Upper attachment part
20	9a	Lower securing element
	9b	Upper securing element
	9c	Pin part
	9d	Helical region
	9e	Limb
25	9f	Curved region
	9g	Opening region
	9h	Lower pin limb
	9i	Pin web
	9h	Upper pin limb
30	10	Opening
	11	Groove

- L Longitudinal direction
- Z Enlargement region

Claims

1. Suspension device for a rail, in particular a rail of an overhead conveyor or a lifting gear, having a tensile element which includes a threaded rod and at least one connection part screwed thereto, and having a securing element which prevents the screw connection between the threaded rod and the connection part from being loosened, characterised in that the securing element (9a, 9b) engages with a pin part (9c) into a groove (11) in the assembled state, said groove being disposed in the threaded rod (7b).
2. Suspension device as claimed in Claim 1, characterised in that the securing element (9a, 9b) engages into the groove (11) with the pin part (9c) through an opening (10) in the connection part (7a, 7c) in the assembled state.
3. Suspension device as claimed in Claim 1 or 2, characterised in that the groove (11) extends in the longitudinal direction (L) of the threaded rod (7b).
4. Suspension device as claimed in Claim 3, characterised in that the groove (11) extends in the longitudinal direction (L) of the complete threaded rod (7b).
5. Suspension device as claimed in any one of Claims 1 to 3, characterised in that the securing element (9a, 9b) is formed in the manner of a two-spring connector having two opposing limbs (9e).
6. Suspension device as claimed in Claim 5, characterised in that, in the assembled state of the securing element (9a, 9b), the limbs (9e) engage behind the sleeve-shaped connection part (7a, 7c), as seen in the direction of the pin part (9c).
7. Suspension device as claimed in any one of Claims 1 to 6, characterised in that the opening (10) is formed as an elongate hole, whose longitudinal extension is oriented in the longitudinal direction (L) of the threaded rod (7b), and the pin part

(9c) is formed in a u-shaped manner as seen transversely with respect to its insertion direction and as seen transversely with respect to the longitudinal direction (L) of the threaded rod (7b).

- 5 8. Suspension device as claimed in any one of Claims 1 to 7, characterised in that the tensile element (7) includes, in addition to the threaded rod (7b), a lower connection part (7a) and an upper connection part (7c).
- 10 9. Suspension device as claimed in Claim 8, characterised in that in the assembled state the rail (2) is suspended on the lower connection part (7a) and the upper connection part (7c) is attached to a supporting element (3).