

Description

Method for Damping Impulses on Guide Rollers

5 The invention relates to a method for damping impulses on guide rollers using a damping pad and a damping pad.

10 An arrangement for guiding devices and/or machines movable on rails, in which guide rollers are used that roll along a rail about a vertical axis, in particular along the side surface of a rail head, is known, for example, from DE 10 2012 111 320 B3. The guide rollers are usually arranged in pairs on both sides of the rail. They are arranged below a base plate. A guide roller lies tangentially against one side of the rail. Opposite the rail is a head plate, on which a damping pad is arranged facing the guide roller. If the rail does not run straight or if a lateral offset occurs at the transition from one rail to the next, an impulse is exerted on a guide roller that acts perpendicular to the guide roller's axis and can damage the guide roller. To prevent or at least mitigate such damage, the damping pad engages with its engagement surface facing the guide roller as a result of the impulse. DE 60 2004 000 372 T2 discloses a plate suitable for absorbing compressive loads.

20 This known arrangement has the disadvantage that impulses cannot be optimally absorbed.

The invention is therefore based on the object of improving the damping of impulses when they act on the guide roller.

25 This object is solved by a method according to claim 1 and by a damping pad according to claim 5.

30 The method according to the invention for damping an impulse on a guide roller, in which a guide roller rotates about a perpendicular axis on a rail provides that, upon the occurrence of a radially acting impulse, the guide roller engages with a damping pad made of elastic material arranged tangentially to the circumference of the guide roller, wherein the engagement surface of the damping pad has recesses and deformation of

the damping pad upon an occurring impulse first takes place into a recess. The recesses facilitate easier deformation of the engagement surface of the damping pad and thereby ensure better, i.e., faster and more extensive, dissipation of the impulse energy, so that the guide roller is subjected to less stress from lateral or tangential impacts. This in-
5 creases the service life of the guide roller and prevents damage to the equipment or machines guided by the guide roller.

The deformation of the engagement surface of the damping pad can be elastic or plastic, depending on the intensity of the impulse. In any case, the recesses according to the
10 invention provide space for accommodating material of the damping pad in the immediate vicinity of the guide roller. If a plurality of impulses or an extremely large impulse occurs, plastic deformation of the engagement surface of the damping pad into the recess may occur. According to the invention, the recesses can be leveled out, so that the engagement surface of the damping pad, which is originally preferably flat, can subse-
15 quently become approximately concave. Alternatively, the damping pad may have a convex engagement surface at the start of use, which becomes approximately flat as the recesses are leveled out.

If further and/or stronger impulses act on the damping pad, a rim contour of the damp-
20 ing pad may also deform elastically or plastically.

In this context, the damping pad according to the invention is made of an elastic material and has an engagement surface provided with a recess. The damping pad is made, for example, of rubber or a synthetic, elastic plastic, such as polyamide. It has an en-
25 gagement surface facing the guide roller, which is designed to absorb impulses acting on the guide roller which rotates about a vertical axis along a rail. According to the invention, this engagement surface is provided with at least one recess. The recesses are set back from the engagement surface. The damping pad typically has a thickness of 5 mm to 50 mm, often between 8 mm and 25 mm. The length and width of the damping
30 pad can be freely selected, depending on the guide roller to be damped and head plate. The length can, for example, be up to 10 cm and the width up to 8 cm.

In a preferred embodiment, the damping pad has an engagement surface with a closed rim. If the rim or the rim contour of the damping pad is closed - that is, not interrupted by a recess - the damping pad remains longer intact as a uniform damping pad even if the rim contour deforms. It does not disintegrate.

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In a further preferred embodiment, the damping pad has a recess that is circular, ring-shaped oval, or irregularly ring-shaped. Furthermore, this ring-shaped recess does not penetrate the rim of the damping pad. Alternatively or additionally, at least one elongated recess may be provided, advantageously a rod-shaped, zigzag, or spiral recess
10 that does not penetrate the rim of the damping pad, e.g., a rod-shaped recess arranged within a ring-shaped recess.

A damping pad in which at least two recesses are arranged in the engagement surface proves to be particularly advantageous. While it is possible, particularly in the case of
15 an irregularly ring-shaped recess, to achieve an even distribution of the recess across the engagement surface, it is equally possible to incorporate two or more recesses into the engagement surface.

Another advantageous embodiment of the damping pad provides that the recess or recesses are arranged concentrically, for example in a spiral pattern or in concentric rings
20 or ovals.

The damping pad of the invention preferably has an engagement surface in which the recesses occupy 10% to 70%, preferably 30% to 50%, of the engagement surface. It is
25 particularly preferred that a recess is arranged in the center of the engagement surface. Furthermore, the damping pad preferably has a thickness that is typically between 3 mm and 30 mm. Furthermore, the recess preferably occupies 10% to 80% of the thickness of the damping pad, advantageously 20% to 80% of the thickness, and particularly preferably 25% to 60% of the thickness of the damping pad. Finally, it is preferred that
30 the distance of a recess from a rim of the engagement surface corresponds to at least one-quarter to one full width of the recess, preferably half the width of the recess. Each of the embodiments described above, and in particular a combination of two or more of the aforementioned embodiments, ensures that the engagement surface does not

buckle when subjected to an impulse, but rather deforms elastically or plastically in the desired manner to prevent load from being transmitted to the respective guide roller to be damped.

5 The recess is advantageously designed with a rounded or V-shaped cross-section to avoid notch stresses. The recess may have a variable cross-section along its length, both with regard to the shape of the cross-section and with regard to the width or depth of the recess. This allows the design of the recess's cross-section to be configured, for example, depending on the expected loads and/or the position within the engagement
10 surface. A recess that is rounded or V-shaped results in a damping pad that is wider at the base of the recess than in the plane of the engagement surface. This design also prevents buckling of the engagement surface, particularly in conjunction with the features of the damping pad described above.

15 During elastic or plastic deformation, the material of the damping pad initially shifts toward the adjacent recess or fills the recess. The engagement surface of the damping pad is designed by the recess or recesses in such a way that the recesses do not cause buckling effects in the engagement surface. This is achieved both by the rounded or V-shaped cross-section of the recesses and by the measures described above. Avoiding
20 buckling effects ensures that a continuous deformation behavior or profile can be established that is adapted to the load cases or impulses that occur. Thus, according to the invention, optimal damping of impulses is ensured while simultaneously ensuring a long service life of the damping pad.

25 In a preferred embodiment, the damping pad is received in a recess in the head plate. The recess is advantageously longer and/or wider than the damping pad, but not as deep as the damping pad. The depth of the recess is preferably approximately 15% to 60% of the thickness of the damping pad, in particular approximately 25% to 35%. Alternatively, the damping pad can be applied to the head plate, e.g., by gluing.

30 If the damping pad is inserted into a recess in the head plate, it is preferable for the edge of the recess to be designed with a radius of at least 1 mm, preferably up to 3 mm. If the damping pad is elastically or plastically deformed by the acting impulses to such

an extent that it comes into contact with the edge of the recess, the rounded edge ensures that no notches form in the damping pad. This prevents the damping pad from splitting and ensures a long service life for the damping pad.

- 5 The damping pad of the invention is preferably used in an arrangement for guiding guide rollers. There, it dampens, in particular, impulses acting laterally—e.g., due to offset rails—on the guide rollers rotating about a vertical axis.

10 It is evident from the foregoing that the various embodiments of the invention described herein can be freely combined with one another.

Details of the invention are explained below with reference to the figures. They show:

- Fig. 1 a top view of a damping pad according to the invention, shown schematically,
15 Fig. 2 a cross-section A-A through the damping pad of Fig. 1,
Fig. 3 a cross-section through a damping pad arranged in a head plate.

The damping pad 1 is made of elastic plastic, e.g., polyamide. It has, for example, a length of 10 cm and a width of 7 cm. The thickness is, for example, 1.8 cm. The dimensions of the damping pad 1 can be adjusted depending on the guide roller to be damped.
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The damping pad 1 has an engagement surface 2 in which an oval ring-shaped recess 3 and a rod-shaped recess 4 are formed. The recess 3 may alternatively be circular or irregularly ring-shaped. A second ring-shaped recess may optionally be provided, e.g., concentric with the recess 3 shown in Fig. 1. The rod-shaped recess 4 is located within the oval ring-shaped recess 3. The rod-shaped recess 4 may alternatively be shaped, for example, in a wavy, zigzag, or spiral pattern. None of the recesses 3, 4 penetrates a rim 5 of the damping pad 1. The rod-shaped recess 4 runs through the center of the engagement surface 2.
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In the embodiment shown in Fig. 1 and Fig. 2, the recesses 3, 4 have a semicircular cross-section. They extend over approximately 20% of the thickness of the damping pad 1. Alternatively, recesses occupying 10% to 80% of the thickness of the damping

pad would be possible. The recesses 3, 4 have a uniform cross-section. Alternatively, it is possible to incorporate cross-sections of a recess or the recesses that vary along the length, adapted to the guide roller to be damped or the expected impulses.

5 The spacing of recess 3 is, as shown in Fig. 1 and Fig. 2, approximately half the width of the recess. It may alternatively be selected to be smaller, or preferably larger. As can be seen from Fig. 1 and Fig. 2, the remaining engagement surface 2 is larger than that of the recesses 3, 4. In the present embodiment, the recesses 3, 4 occupy approximately 30% of the surface area of the engagement surface 2. In other embodiments, they may
10 occupy between 10% and 70% of the surface area of the engagement surface 2. The rim 5 of the damping pad 1 is closed; it is not penetrated by a recess 3, 4. Recess 4 maintains a distance from the rim 5 of the damping pad that corresponds to half the width of recess 4. In particular, the distance can be selected to be between one-quarter and one full width of a recess.

15 Fig. 3 shows the damping pad according to Figs. 1 and 2, which is arranged in a head plate 6. The head plate 6 is mounted on a base plate not shown here, such that the head plate can accommodate the damping pad 1 so that, when impulses occur, it can dampen the guide roller—that rotates about a perpendicular axis which is also mounted on the
20 base plate—and is likewise not shown here. The head plate 6 is, for example, made of metal. In the embodiment shown here, it features a recess 7. The recess 7 has dimensions at least sufficient to accommodate the damping pad 1, wherein, in the embodiment shown here, the length and width of the recess 7 are larger than the dimensions of the damping pad 1. The recess 7 extends over approximately 40% of the thickness of the
25 head plate 6. It accommodates approximately 30% of the thickness of the damping pad 1. The edge 8 of the head plate 6 is rounded, here with a radius of 1.5 mm.

The method according to the invention for damping a guide roller proceeds as follows: The guide roller, which, based on the example in Fig. 3, is arranged to the left of the
30 damping pad 1 and rotates about a vertical axis, rolls along a rail. When switching to a subsequent rail that is not laid exactly in alignment, or in the event of a lateral displacement of the rail, an impulse is exerted on the guide roller rolling off this rail or these rails. Without damping, this causes the guide roller to swing out rapidly and be

destroyed. With the damping according to the invention, however, the service life of the guide roller can be significantly extended.

5 The impulse is transmitted from the guide roller to the damping pad 1, which is located opposite the guide roller or, when the impulse acts, in contact with engagement surface 2 (on the guide roller), and is absorbed and dissipated by the damping pad 1. This occurs by the material of the damping pad 1 first deforms elastically, specifically from the engagement surface 2 into the recesses 3, 4. The path from the point of impact of the impulse on engagement surface 2 to recesses 3, 4 is short, and the above-described, inventive design of damping pad 1, in which there is more material at the base or bottom of recess 3, 4 is greater than at the engagement surface 2, prevents undesirable buckling of the engagement surface 2 during the damping of an impulse.

15 If the impulse to be damped is so large that plastic deformation of the damping pad 1 occurs during damping, the material of the damping pad 1 is displaced from the engagement surface 2 toward the recesses 3, 4, so that the recesses 3, 4 become flatter or are leveled. Accordingly, the engagement surface 2 becomes concave. Furthermore, when damping large impulses, the rim 5 of the damping pad may be displaced outward, such that the damping pad 1 initially fills the recess 7 and then slides beyond the edge 8. To keep the damping pad 1 functional for as long as possible even in this deformed state and to ensure optimal damping of occurring impulses for as long as possible, the edge 8 of the recess is preferably rounded so that the rim 5 of the damping pad 1 is not damaged.

25 Table 1 shows a measurement of the damping effect on a damping pad without a recess and on damping pads according to the invention. All damping pads have a height of approximately 10 mm. The length of the damping pads is 100 mm, and the width is 50 mm. The damping pads are inserted into a head plate with a 4 mm recess. A 10 mm thick plate is used as the test specimen. The test is performed by applying a compressive force using a hydraulic press to the plate, which rests against the engagement surface, whereby the spring travel (specified in Table 1 as "Travel in mm") is increased by 0.5 mm from test to test up to a maximum deflection of the spring or the guide roller of

a total of 4 mm. The force in each case required to deflect the spring is captured immediately at the end of the test, before the value can be altered by setting loss.

It was determined in advance for all damping pads that no loss of height of the damping pad was detectable after a single actuation of the spring. All damping pads were initially preloaded three times. Then the values shown in Table 1 were determined. Damping pad 2 features four evenly spaced, continuous recesses that penetrate the rim of the damping pad. Damping pad 3 features four evenly spaced, parallel recesses that do not penetrate the rim of the damping pad. Damping pad 4 features a first, centrally located, oval recess, in the center of which a second, elongated recess is arranged, which does not penetrate the first, outer recess. The recesses all have a width of 7 mm and a depth of 4 mm, with a U-shaped cross-section. The recesses of test specimens 3 and 4 are spaced at least 5 mm from the rim of the damping pad.

Travel in mm	Force in kN			
	No. 1	No. 2	No. 3	No. 4
0.0	0.2	0.2	0.2	0.2
0.5	5.0	4.0	4.0	5.8
1.0	11.0	10.0	10.0	11.0
1.5	16.0	15.0	15.5	15.0
2.0	22.0	20.0	21.0	19.0
2.5	32.0	26.0	28.0	24.0
3.0	48.0	37.0	40.0	35.0
3.5	71.0	56.0	59.0	52.0
4.0	107.0	85.0	91.0	80.0

It can be seen that the damping pad without recesses (test specimen No. 1) allows for approximately linear force absorption up to a spring deflection of 2 mm; thereafter, the force absorption increases disproportionately.

The damping pads, or test specimens 2 to 4, each of which has recesses, show approximately linear force absorption up to a spring deflection of approximately 2.5 mm;

thereafter, these test specimens also show disproportionate force absorption, which is, however, significantly lower than that of test specimen 1 without recesses.

5 The force absorption of test specimen 4, which features a closed, oval recess and a linear recess within the oval recess, shows a reduction in force absorption of approximately 25% at a spring travel of 4 mm. Test specimen No. 3 shows the smallest deviation from the damping pad without a recess. Nevertheless, this value is still 15% lower than that of test specimen 1.

List of reference symbols

	1	damping pad
	2	engagement surface
5	3	oval ring-shaped recess
	4	rod-shaped recess
	5	rim of the damping pad
	6	head plate
	7	recess
10	8	edge

Claims

1. A method for damping an impulse on a guide roller, wherein a guide roller rotating about a perpendicular axis on a rail engages a damping pad (1) made of elastic material and arranged tangentially to the circumference of the guide roller upon the occurrence of a radially acting impulse, wherein the engagement surface (2) of the damping pad facing the guide roller (1) has recesses (3, 4), and deformation of the damping pad (1) upon the occurrence of an impulse first takes place into a recess (3, 4).
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2. Method according to claim 1, characterized in that the deformation displaces the elastic material of the damping pad (1) into the recess (3, 4).
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3. A method according to claim 1 or 2, characterized in that the deformation of the elastic material leads to the leveling of the recesses (3, 4).
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4. A method according to any one of claims 1 to 3, characterized in that the application of an impulse after the recesses (3, 4) have been leveled leads to the deformation of a rim (5) of the damping pad (1).
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5. A damping pad (1) for damping an impulse at a guide roller, wherein the damping pad (1) is made of an elastic material and has an engagement surface (2) provided with a recess (3, 4).
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6. Damping pad (1) according to claim 5, characterized in that the engagement surface (2) has a closed rim (5).
7. Damping pad (1) according to claim 5 or 6, characterized in that the recess (3, 4) is circular, ring-shaped oval, irregularly ring-shaped, or elongated.
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8. A damping pad (1) according to any one of claims 5 to 7, characterized in that at least two recesses (3, 4) are arranged in the engagement surface.

9. A damping pad (1) according to any one of claims 5 to 8, characterized in that the recesses (3, 4) are arranged concentrically.
- 5 10. A damping pad (1) according to any one of claims 5 to 9, characterized in that the recesses (3, 4) occupy 10% to 70% of the engagement surface (2).
11. A damping pad (1) according to any one of claims 5 to 10, characterized in that the damping pad (1) has a thickness, and that the recesses (3, 4) occupy 10% to 80% of the thickness of the damping pad (1).
- 10 12. A damping pad (1) according to any one of claims 5 to 11, characterized in that a distance of a recess (4) from a rim (5) of the engagement surface corresponds to at least one-quarter to one full width of a recess (4).
- 15 13. A damping pad (1) according to any one of claims 5 to 12, characterized in that the recess (3, 4) has a variable cross-section along its length.
14. Damping pad (1) according to any one of claims 5 to 13, characterized in that it is inserted into or attached to a head plate.
- 20 15. Damping pad (1) according to claim 14, characterized in that the head plate has a recess.