ABSTRACT

A roller for belt tensioning systems or wrap drives having a hollow hub and a cylindrical running ring. The hollow hub and the running ring are connected to one another by an annular web and wherein, on both sides of the annular web, the hollow hub and the running ring are supported relative to one another by circumferentially distributed radially arranged ribs. The number of ribs on both sides of the annular web can be a prime number. In addition, or in the alternative, the ribs on both sides of the annular web can be arranged so as to be non-centrally circumferentially offset. In addition, or in the alternative, the number of ribs on both sides of the annular web can deviate from one another. In addition, or in the alternative, the rib assembly can be provided with variable pitch angles around the circumference.
ROLLER WITH WEAKENED EXCITATION BEHAVIOUR

BACKGROUND OF THE INVENTION

[0001] The invention relates to a roller for belt tensioning systems or wrap drives. The roller has a hollow hub and a cylindrical running ring, wherein the hollow hub and the running ring are connected to one another by an annular web. On both sides of the annular web, the hollow hub and the running ring are supported relative to one another by circumferentially distributed radially arranged ribs. The rollers can be produced in the form of homogeneous injection-moulded parts out of plastics and thereby may be lightweight and cost-effective. This can be important because they are parts of systems which may be susceptible to vibrations. In addition, the plastic material can have advantageous acoustic properties. During an injection-moulding process, the roller can be injection-moulded via a plurality of injection points which, for example, are arranged so as to be circumferentially distributed. One design having ribs ensures dimensional stability while being lightweight. One purpose is to prevent the running ring from becoming spherically deformed under the force of a tensioned belt as this could lead to increased belt wear and to roller fatigue.

[0002] When the rollers produced as injection-moulded plastic parts are removed from their moulds, a cooling and hardening process can be provided which can lead to a shrinking process which depends on the distribution of material around the circumference. For example, the ribs can constitute an accumulation of material which can be subject to a smaller degree of shrinkage than the free running ring, so that the running ring, in an axis-normal section through the axis of rotation, can assume the shape of a polygon, or if viewed as a whole, as a multi-edged shape or a hollow cylinder shape on a polygonal base. The corners or cylinder edges can be associated with the supporting ribs, whereas the intermediate running face regions can be substantially planar. The distribution of the injection points around the circumference can intensify this effect, or can be superimposed because in the region of the injection points, the running ring can cool and solidify prematurely, which can also affect the shrinking process. As a result of this too, corners and cylinder edges can be provided in a small number at the roller member and which can be superimposed to an intensifying effect on the above-mentioned corners and cylinder edges, such as at the ribs.

[0003] One consequence of these shapes can be that in the tight strand of a moving belt, when moving over a roller, periodic longitudinal loads can occur and thus periodic elongations can lead to a considerable amount of noise. In addition, pulses can occur when the individual edges of a multi-edged shape hit an inner face of the belt which can lead to acoustic excitations. The effects can be most pronounced when the excitation frequency of the tight strand corresponds to that of the belt tensioning system, and a resonance occurs.

[0004] Such effects are not preferable because, from the point of view of comfort, they have an interfering effect and, from the point of view of operational safety, they adversely affect the service life of the belt and of the roller.

OBJECT OF THE INVENTION

[0005] It is therefore the object of the present invention to provide an improved roller which retains a simple and cost-effective design while providing an improved and diminished excitation characteristics.

SUMMARY OF THE INVENTION

[0006] A first solution according to the invention comprises providing a roller having a hollow hub and a cylindrical running ring. The hub and running ring can be connected to one another by an annular hub. On both sides of the annular hub, the hollow hub and the running ring can be supported relative to one another by circumferentially distributed and radially arranged ribs. The number of ribs on both sides of the annular web can be a prime number, preferably greater than or equal to 7. Several other embodiments include providing the number of ribs as 29, 31 or 37.

[0007] The ribs on both sides can be in the same circumferential position or, centrically offset relative to one another.

[0008] Surprisingly, it has been found that as a result of this arrangement, wherein the outer running face is provided with a multi-edged shape, the excitations can be reduced considerably, because the even-numbered main excitation orders of the belt tensioning system are not affected. In addition, little or no additional costs are required as compared to prior art rollers, and little or no weight disadvantages.

[0009] A second solution includes providing a device according to the invention wherein ribs on both sides of the annular web in the same number, and which are circumferentially offset relative to one another. More particularly, the ribs on one side of the annular web can be non-centrically offset relative to the ribs on the other side of the annular web by a fraction of the pitch angle, e.g. by a quarter of the pitch angle. In this case, too, it is possible to select a prime number for the number of ribs.

[0010] By providing such arrangements according to the invention, the multi-edged shape can be interrupted and weakened in that the number of rib connections at the running ring can be doubled around the circumference, even if each rib supports only half the width of the running face. In addition, a roller can be provided with an improved roundness of its running face. The resulting advantageous properties in an acoustic respect are easily understood. A larger number of excitations around the circumference can be provided, but which are much weaker than otherwise. In addition, it is possible to approach an ideally cylindrical running face. Preferably the number of pairs of ribs and injection points are provided as prime numbers.

[0011] A third solution comprises providing a device according to the invention wherein the numbers of ribs on both sides of the annular web deviate from one another. More particularly, such a device can be provided wherein the numbers of ribs on both sides of the annular web are prime numbers, e.g. 29 and 31. This measure, too, allows the effect of the polygonal cross-section of the running face to be partially interrupted, and a continuous change in the distance between the rib assemblies provided at the running ring around the circumference such that the flattening of the running face and the excitations are not periodical. The effect is the same as in the case of the above-described solution.

[0012] A fourth solution comprises a device according to the invention wherein the ribs around the circumference are variably spaced. Smaller pitch angles can be provided on one side of the annular web and greater pitch angles can be provided on the other side of the annular web. Accordingly, in spite of non-uniform pitch angles which may be provided around the circumference, a general symmetry of the roller can be maintained. In this solution as well, it is an object to interrupt the periodicity, and as a result of the uniformly supportive ribs on the circumference, the running ring is provided with a reduced excitation and thereby avoids the occurrence of resonance. In this case, too, the number of ribs can be prime numbers.
As mentioned initially, another disadvantage of prior art rollers results from the production process in that the material is injected into a mould via a number of circumferentially distributed injection points, for example at an end face of the hollow hub. This results in additional deviations from the preferred roundness of the running face in the sense of a multi-edged shape.

Accordingly, a device according to the invention can be provided wherein the number of injection points is a prime number, and depending on the size of the roller and number of ribs, the preferred number of circumferentially distributed injection points can be 5, 7, 11 or 17. Although an out-of-roundness of the running ring may still be caused by shrinkage, transience and resonance effects can be avoided or at least reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention are illustrated in the drawings and are described below.

FIG. 1 illustrates an inventive roller in a first embodiment, with the number of ribs being a prime number

a) in an axial view,
b) in a radial view, and
c) in a radial section through the axis.

FIG. 2 illustrates an inventive roller in a second embodiment, with the ribs on both sides being circumferentially offset relative to one another

a) in an axial view,
b) in a radial view, and
c) in a radial section through the axis.

FIG. 3 illustrates an inventive roller in a third embodiment, with the ribs on both sides being provided in different numbers

a) in an axial view,
b) in a radial view, and
c) in a radial section through the axis.

DETAILED DESCRIPTION

The individual illustrations of FIG. 1 are described jointly below. One embodiment of a roller 11 according to the invention comprises an annular-cylindrical hollow hub 12, an outer cylindrical running ring 13 and an axis-normal, radially extending annular web 14 which can connect the two above-mentioned parts in a symmetric arrangement. The hollow hub 12 can form an inner seat face 15 for receiving a rolling-contact bearing, and the running ring 13 can comprise a smooth cylindrical outer running face 16 on which a belt of a belt tensioning system or of a wrap drive can move. The roller 11 can be substantially stationary, or it can be arranged in a resilient belt tensioning device with pretension so as to be resilient relative to the movement of the belt. On both sides of the annular web 14, circumferentially distributed radial ribs 17, 18 can be arranged and which can be homogeneously connected to the inside of the running ring 13 at the annular web 14 and at the outside of the hollow hub 12. The roller 11 can be fabricated entirely of plastics.

The ribs 17, 18 can be arranged in pairs, uniformly distributed on both sides of the annular web. In one embodiment, the number of the ribs 17, 18 can be provided as a prime number, such as 11.

On one of the end faces of the hollow hub 12, the injection points 19 can be provided during the production process. The number of injection point can be a prime number, such as 11.

In FIG. 2, any details corresponding to those given in FIG. 1 have been given the same reference numbers. To that extent, reference is made to the above description. In another embodiment of a device according to the invention, the ribs 17 and 18 can be provided having the same shape as above and can be provided in an equal number, preferably a prime number. For example, there can be 29 ribs 17, 18, each, but the first set of ribs 17 are preferably offset circumferentially by a quarter of the pitch angle relative to the second set of ribs 18.

In FIG. 3, any details corresponding to those given in FIG. 1 have been given the same reference numbers. To that extent, reference is made to the above description. A device according to the invention can be provided with ribs 17, 18 which are uniformly and circumferentially distributed on each of the sides of the annular web, but ribs on one side are provided in different numbers than ribs on the other side. Accordingly, the pitch angle of a first set of ribs 17 can deviate from that of a second set of ribs 18. Accordingly, the number of first set of ribs 17 in one embodiment can be 29, wherein the number of the second set of ribs 18 can be 31. In addition or in the alternative, a device according to the invention can be provided with a number of injection points 19 at an end face of the hollow hub 12 which number is preferably a prime number, such as 11.

Accordingly, a device according to the invention features an improved roundness as compared to prior art rollers, wherein on both sides of the annular web there are provided ribs with identical pitch angles, more particularly in an even-numbered arrangement, with the ribs being arranged identically and in pairs positioned opposite one another, so that the running face comprises a clearly defined multi-edged shape. The above-described inventive rollers can also provide an improved roundness and/or weakened excitation behaviour.

1. A roller (11) for belt tensioning systems or wrap drives, comprising a hollow hub (12) and a cylindrical running ring (13), wherein the hollow hub (12) and the running ring (13) are connected to one another by an annular web (14) and wherein, on both sides of the annular web (14), the hollow hub (12) and the running ring (13) are supported relative to one another by a plurality of circumferentially distributed radially arranged ribs (17, 18), and wherein the number of ribs (17, 18) on both sides of the annular web (14) is a prime number.

2. A roller according to claim 1, wherein the number of the ribs is selected from the group of 29, 31 or 37.

3. A roller (11) for belt tensioning systems or wrap drive, comprising a hollow hub (12) and a cylindrical running ring (13), wherein the hollow hub (12) and the running ring (13) are connected to one another by an annular web (14) and wherein, on both sides of the annular web (14), the hollow hub (12) and the running ring (13) are supported relative to one another by a plurality of circumferentially distributed radially arranged ribs (17, 18), and wherein the ribs (17, 18) on both sides of the annular web (14) are provided in identical numbers and are circumferentially offset relative to one another.
4. A roller according to claim 3, wherein the ribs (17) on one side of the annular web are non-centrally offset relative to the ribs (18) on the other side of the annular web by a fraction of the pitch angle of the rib assemblies.

5. A roller (11) for belt tensioning systems or wrap drives, comprising a hollow hub (12) and a cylindrical running ring (13), wherein the hollow hub (12) and the running ring (13) are connected to one another by an annular web (14) and wherein, on both sides of the annular web (14), the hollow hub (12) and the running ring (13) are supported relative to one another by a plurality of circumferentially distributed radially arranged ribs (17, 18), and wherein the numbers of ribs (17, 18) on both sides of the annular web (14) deviate from one another.

6. A roller according to claim 5, wherein the numbers of ribs (17, 18) on both sides of the annular web (14) comprise successive prime numbers.

7. A roller (11) for belt tensioning systems or wrap drives, comprising a hollow hub (12) and a cylindrical running ring (13), wherein the hollow hub (12) and the running ring (13) are connected to one another by an annular web (14) and wherein, on both sides of the annular web, the hollow hub and the running ring are supported relative to one another by a plurality of circumferentially distributed, radially arranged ribs (17, 18), wherein the pitch angles of the rib assembly between the ribs (17, 18) vary around the circumference and include smaller pitch angles and greater pitch angles.

8. A roller according to claim 7, wherein the smaller pitch angles on one side of the annular web (14) are located opposite greater pitch angles on the other side of the annular web (14) and the greater pitch angles on the one side of the annular web (14) are located opposite the smaller pitch angles on the other side of the annular web (14).

9. A roller according to claim 1, further comprising a number of circumferentially distributed injection points (19) resulting from the production process, which number is a prime number.

10. A roller according to claim 9, wherein the number of injection points selected from the group of 5, 7, 11 or 13.