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DE 196 54 915 A1

written in GERMAN.

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Sworn to and subscribed before me
this 21st day of October, 2016

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54 Torsional vibration damper with a compensating inertial mass

57 A torsional vibration damper is equipped with a drive-side transmission element and a power-takeoff-side transmission element capable of rotating relative thereto, at least one of which has an activating means for elastic elements of a damping device, and with at least one of which a compensating inertial mass is associated. The latter has a carrier element, which is connected via a coupling means with at least one compensating weight, in which a positional change takes place in correlation with a predeterminable order of the vibrations introduced to the drive-side transmission element.

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The following text is taken from the documents filed by the Applicant

Description

The invention relates to a torsional vibration damper according to the preamble of claim 1.

DE 36 30 398 C2 describes a torsional vibration damper with a drive-side transmission element and a power-takeoff-side transmission element capable of rotating relative thereto, at least one of which has an activating means for elastic elements of a damping device. Even relatively large torsional vibrations, which are also transmitted to the drive-side transmission element upon introduction of a torque by a drive, such as an internal combustion engine, can be reduced by such a torsional vibration damper. The reduction takes place during transmission of the respective torsional vibrations from the drive-side to the power-takeoff-side transmission element via the elastic elements – which are supported by a friction means – of the damping device.

In contrast to a massive flywheel, both inertial masses are relatively light, and so the large primary-side mass, which is composed of the drive and the primary-side inertial mass, is counteracted by a small secondary-side inertial mass, which is braced on the gear-train side. Thereby the resisting torque for a drive, which is determined by the inertia of the primary side and a reaction torque formed by the action of the springs, by friction and by the inertia of the secondary inertial mass, is relatively small, and so it is capable of smoothing out synchronization fluctuations of the drive to only a small extent. The synchronization fluctuations cause torque fluctuations in the secondary aggregates, such as a generator, connected to the front end of the engine. The torque fluctuations may cause damage to these aggregates.

A further possibility for damping drive-side torsional vibrations may lie in providing, according to DE 36 43 272 A1, a torsional vibration damper with a compensating inertial mass, which is mounted to rotate freely relative to the actual inertial mass and by virtue of its mass inertia develops a resisting torque upon introduction of a torsional vibration.

The compensating inertial mass is equipped with spring-mounted compensating weights, which undergo a deflection from their rest position as a function of centrifugal force. Thus the compensating inertial mass is indeed dependent on rotational speed but, because of the spring connection with the compensating weights, the compensating inertial mass is functional with sufficient effect only in frequency ranges determined by the springs, whereas it may fail in other frequency ranges.

The task of the invention is to improve a torsional vibration damper to the effect that vibrations delivered by a drive, such as an internal combustion engine, can be filtered out independently of frequency.

This task is accomplished according to the invention by the features specified in the body of claim 1.

According to the invention, the compensating inertial mass is equipped with compensating weights, which are coupled via a coupling means with a carrier element of the compensating inertial mass and are matched to a particular order of the drive. One possibility for the order is the ignition excitation, which depends on the number of cylinders of the internal combustion engine, so that, depending on the degree of matching of the compensating weights, the ignition excitations can be absorbed at least partly or even completely. Thereby the advantage is achieved that torsional vibrations that, for example in a torsional vibration damper with two inertial masses capable of rotating relative to one another, lead to deformation of the elastic elements acting between the inertial masses, can be reduced at least considerably. This is of special significance in particular when passing through the resonance range of the torsional vibration damper because, if no reduction of the ignition excitations were to be achieved, these could lead to damage or even destruction at least in the region of the elastic elements. Normally this problem is alleviated by making the elastic elements particularly flexible with large spring deflections and disposing them in a chamber filled with viscous fluid, while constructing the inertial masses with large weight. By these features it is possible to limit instability of the motion of the inertial masses relative to one another, especially during passage through the resonance range since, due to the flexible elastic elements constructed with long-stroke spring action and the high inertial mass, the resonance range of the torsional vibration damper is lowered sufficiently that it lies just above the ignition frequency of the internal combustion engine, i.e. in a frequency range in which the ignition excitations have not yet reached full intensity. By using the compensation inertial mass according to the claims, it is now possible to increase the stiffness of the elastic elements of the damping device since, by virtue of the reduced effect of the ignition excitations, the deflection angle between the two inertial masses can be made smaller. Furthermore, it is possible to reduce the weight of the inertial masses. Although the resonance range of the torsional vibration damper is indeed shifted to higher rotational speeds by these aforesaid features, this is uncritical because of the at least partial absorption of the ignition excitations. Furthermore, because of the smaller deflection angle between the inertial masses, it is possible to construct the damping device without viscous fluid as the damping medium. On the whole, therefore, it is possible to reduce the costs and weight of the torsional vibration damper by using the compensating inertial mass.

Advantageously, the compensating inertial mass is disposed in a completely or partly sealed housing, which is filled with a viscous fluid, preferably oil, in order to safeguard the useful life. This housing may contain a coupling means for the compensating inertial mass, such as levers, linkages or roller tracks. The housing may be an independent structural part or be integrated at least partly in another component of the torsional vibration damper, for example in one of the inertial masses.

The invention will be explained in more detail hereinafter on the basis of an exemplary embodiment, wherein:

Fig. 1 shows a compensating inertial mass with compensating weights, which are linked via a coupling means to a carrier element, wherein the center of gravity of the compensating weight lies radially inside the coupling means.

The inventive inertial mass **22** is illustrated in **Fig.** 1. It has a carrier element **102**, on which, for each compensating weight **100**, two guides **104** are provided that respectively extend along a predeterminable angle segment, preferably on a path in the form of a circular segment, and indeed in such a way that their middle region forms the point of guide **104** located furthest outward in radial direction. In contrast to this, compensating weight **100** is formed with guides **105**, which have the same shape as guides **104** but are disposed with inverse direction of curvature. Between guides **104** and **105**, a connecting element **108** in the form of a pin, which is securely retained axially in a way not shown in more detail, is respectively active as part of a coupling means **106**. The function of compensating inertial mass **22** is such that, upon deflection of carrier element **102**, compensating weight **100** tends, because of its inertia, to remain in its initial position and hereby cause a rolling movement of connection elements **106** in guides **104** and **105**.

In compensating weight **100** according to **Fig.** 1, the center of gravity lies radially inside connecting element **108**. This is of advantage in particular when compensating inertial mass **22** is disposed in a housing **110** filled at least partly with viscous fluid, such as oil, and the oil migrates radially outward under the action of centrifugal force upon rotation of the torsional vibration damper. For this case, connecting elements **108** are still always disposed inside the oil ring and therefore in a lubricant. On the other hand, an air layer, which surrounds carrier element **102** and compensating weight **100** received thereby and acts as insulation relative to the wall of housing **110**, is formed radially inside the oil ring, and so compensating inertial mass **22** may also be

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