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DE 196 18 864 A1

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Sworn to and subscribed before me
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GERMAN PATENT OFFICE

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56 Opposition references:
DE 44 26 317 A1

Request for examination filed in accordance with § 44 Patent Act

54 Torsional vibration damper with a compensating inertial mass

57 A torsional vibration damper is provided with a drive-side transmission element and with a power-takeoff-side transmission element that can be rotated 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. At least one of the transmission elements has a recess for receiving the compensating inertial mass, which at least in its zone of contact with a guide race of the recess is provided with a curvature for a rolling motion of the compensating inertial mass to take place along the guide race upon introduction of a torsional vibration.

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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 43 272 A1 describes a torsional vibration damper that has an inertial mass as a drive-side transmission element and a clutch plate that can be rotated relative thereto and disposed on a gear shaft, to rotate therewith, as a power-takeoff-side transmission element, wherein the latter has activating means for elastic elements of a damping device. The clutch plate is connected via a shift clutch having a compensating inertial mass, which is mounted in freely rotatable relationship relative to the actual inertial mass and on the basis of its mass inertia develops a resisting moment upon introduction of a torsional vibration.

The compensating inertial mass is provided with spring-mounted compensating weights, which experience a deflection from their rest position as a function of centrifugal force.

Thus the compensating inertial mass is indeed effective as a function of rpm, but on the basis of a spring connection with one of the transmission elements it is functional with sufficient action only in frequency ranges determined by the springs, but can fail in other frequency ranges.

DE 43 03 303 C1 shows the release cylinder area of a torsional vibration damper provided with a compensating inertial mass. The compensating inertial mass has a shift clutch in operative connection with the release cylinder, so that upon disengagement the compensating inertial mass is decoupled from the power takeoff side. This is advantageous because the rpm equalization of the gear shaft to the speed corresponding to the gear to be engaged takes place rapidly by the gear synchronization, and in addition the smallest possible moment of inertia on the power takeoff side is supposedly achieved. A disadvantage of the torsional vibration damper according to that patent, however, is that it is effective only at a natural frequency determined by spring elements of the compensating inertial mass.

US Patent 5 295 411 teaches an inertial mass that receives a circular compensating inertial mass in each of a multiplicity of circular recesses, wherein the diameter of the said mass is smaller than that of the recess. Such an inertial mass is commonly known as a "Salomon absorber" and it has the advantage that the speed of deflection of the compensating inertial masses is dependent on rpm changes of the inertial mass, and so the inertial mass is active as a function of rpm. With such an inertial mass, torsional vibrations of a certain order, preferably the second order in four-cylinder internal combustion engines, can be decreased extremely well by a

certain amount at certain amplitude magnitudes, but the possibility of acting on vibrations of other orders is lacking.

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 rotation relative thereto, wherein an inertial mass is associated with each of these transmission elements. Such torsional vibration dampers are suitable for filtering a complete frequency range, i.e. for damping amplitudes of different orders. In particular, interfering amplitudes of a certain order cannot be suppressed as effectively as would often be necessary.

The object of the invention is to improve a torsional vibration damper to the effect that the vibrations generated by a drive, such as an internal combustion engine, can be filtered out as well as possible.

This object is achieved according to the invention by the features specified in the body of claim 1.

By the special configuration of a torsional vibration damper with at least one compensating inertial mass, an overall device is obtained in which the advantages of the torsional vibration damper active as the filter for a complete frequency range can be combined with the advantage of compensating inertial masses that counteract a vibration of certain order. By virtue of the structure of the transmission element with at least one recess, which at least in its zone of contact with the at least one compensating inertial mass is provided with a guide race, on which the compensating inertial mass, which has a curvature, is able to execute a rolling motion upon introduction of a torsional vibration, this transmission element contains a so-called "Salomon absorber", in which a high speed of deflection at the transmission element always also results in a high speed of deflection of the compensating inertial mass from its rest position. In this connection, the compensating inertial mass can be dimensioned in such a way that it is effective for vibrations of a certain order and, in fact, in such a way that the amplitude magnitude of this vibration is reduced by a certain amount.

Furthermore, the damping behavior of this "Salomon absorber" is determined by geometric ratios, such as the respective bend of the guide race relative to the curvature of the compensating inertial mass in the zone of contact with the guide race as well as by the vibration angle of the compensating inertial mass.

The Salomon absorber can be designed particularly simply when both the guide race on the recess of the transmission element and the curvature on the compensating inertial mass are respectively of circular shape at least in the mutual contact zone, wherein the guide race is formed with a larger radius than the compensating inertial mass to ensure movement of the compensating inertial mass.

The latter structural feature can have the consequence that, when the torsional vibration damper is stationary and centrifugal force is no longer acting on the compensating inertial mass, this falls downward under the action of gravity to the other end of the recess. Upon restart of the torsional vibration damper, the compensating inertial mass is accelerated radially outward, until it impinges on the corresponding zone of the guide race there. This problem is eliminated by the fact that, according to the claim, a displacement limitation is associated with the guide race to prevent the compensating inertial mass from falling down under the effect of gravity upon stoppage of the torsional vibration damper.

By disposing the inventive Salomon absorber in a torsional vibration damper, in which each transmission element is assigned its own inertial mass, the capability of the Salomon absorber to damp amplitudes of a certain order is combined with an excellent filter, and so a particularly good decoupling quality is achieved.

A further claim shows the combination of the Salomon absorber with a conventional clutch, which has only one inertial mass, wherein an advantageous constructive solution is shown for separating the compensating inertial mass from the power-takeoff-side transmission element by an additional shift clutch as soon as the friction clutch is disengaged.

An exemplary embodiment of the invention will be explained in more detail hereinafter on the basis of a drawing, wherein:

Fig. 1 shows a longitudinal section through a half diagram of the inertial mass device with a hub plate acting as a ring gear and a planet wheel, wherein a recess for receiving a compensating inertial mass of circular cross section is provided in the inertial mass on the power takeoff side;

Fig. 2 is the same as **Fig. 1**, but with a compensating inertial mass of substantially semicircular cross section;

Fig. 3 is the same as **Fig. 1**, but with a recess limited in radial direction;

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