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GB 1440232 A GB 1354804 A GB 1144745 A
EP 0297537 A US 4158403 A US 3790099 A

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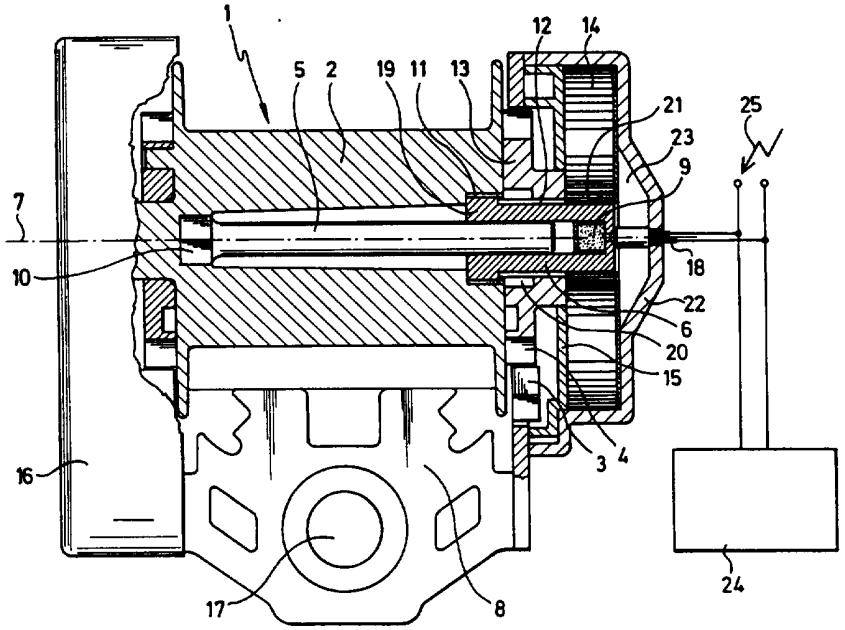
(54) Reel assembly for a safety belt of an automotive vehicle

(57) The assembly has a belt reel (1) for the safety belt, a frame (8) which can be frictionally connected to the structure of the motor vehicle, onto which the belt reel (1) is rotatably mounted and a blocking apparatus (3) which, when there is an excessive change of speed of the vehicle, is effective by engagement between the frame (8) and the belt reel (1). Between a shaft part (2) of the belt reel (1) upon which forces emanating from the belt web act, and an area of engagement (4) of the belt reel (1) with which the blocking apparatus (3) can engage, an energy absorber (5) is provided, which allows a specific extension of the belt web with simultaneous absorption of the energy transferred from the belt web. The energy absorber (5) can be activated simultaneously with an airbag (24) and includes a torsion rod frictionally received in a sleeve (6) which, in an emergency, is moved rightwards by igniting a propellant charge (9).



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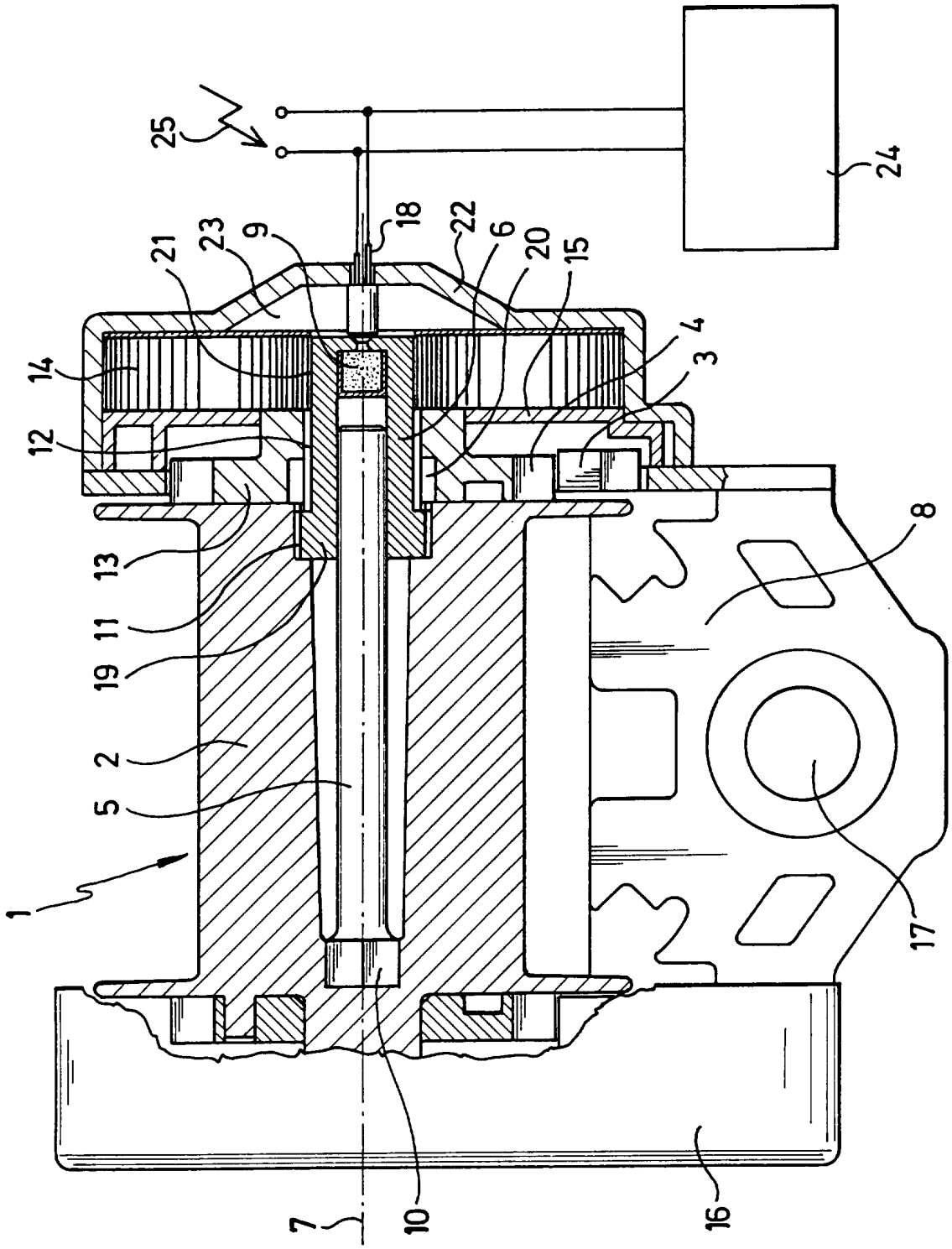
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BELT ROLLER FOR A SAFETY BELT OF AN AUTOMOTIVE VEHICLE

The invention relates to a belt roller for safety belt of an automotive vehicle.

By means of a belt roller of this type, if an accident occurs, a belt reel is blocked from further rotation on a frame by blocking apparatus. In this way further extension of the belt web from the belt roller is prevented. When an accident occurs very large forces can act upon the body of the passenger in the vehicle, which are transferred from the body to the safety belt, which is stopped with respect to further extension of the web. This results in an increased risk of injury to those points of the body in contact with the belt web of the safety belt.

According to the invention there is provided a belt roller for a safety belt of an automotive vehicle, with a belt reel for the safety belt, a frame which can be frictionally connected to the structure of the motor vehicle, on which frame the belt reel is rotatably mounted and a blocking apparatus which, when there is an excessive change of speed of the vehicle, is effective by engagement between the frame and the belt reel, wherein between a shaft part of the belt reel upon which forces emanating from the belt web act, and an area of engagement of the belt reel with which the blocking apparatus can engage, an energy absorber is provided, which allows a specific extension of the belt web with simultaneous absorption of the energy transferred from the belt web.

With such a belt roller the risk of injury from the safety belt to the vehicle passenger restrained by the safety belt due to the safety belt web in contact with the body is reduced.

By means of this a part of the energy transferred during an accident from the body via the safety belt, via the belt reel, the blocking apparatus and the frame to the vehicle structure is consumed in the belt roller. In this way the loading on the points of the body with which the safety belt band is in contact is reduced. The energy absorber provided in the safety belt roller, in particular in the belt reel, consequently acts as a load limiter, as the loading on the passenger restrained by the safety belt in the vehicle seat is reduced.

Above a specific threshold in change of speed of the vehicle, for example

during an accident, the energy absorber is connected between a shaft part of the belt reel upon which forces emanating from the belt web act, and an area of engagement of the belt reel, for example blocking teeth or a blocking apparatus acting in the same manner. The energy absorber is configured so that an energy consuming relative movement is allowed between the shaft part and the area of engagement of the belt reel. In this way a specific energy transferred from the belt web to the shaft part is consumed.

The belt roller can be configured so that below the specific threshold of change in the speed of the vehicle, a direct frictional connection between the part of the shaft and the area of engagement of the belt web with which the blocking apparatus can engage bypasses the energy absorber. In this way it is ensured that during slow changes of vehicle speed, during which the blocking apparatus is engaged with the area of engagement of the belt reel, blocking of the belt reel is brought about in those driving situations in which the loads acting upon the body of the vehicle passenger are below the threshold described, and a feeling of security is also conveyed to the vehicle passenger in those driving situations, for example driving around very sharp bends.

Above the specific threshold of change of vehicle speed, in particular when an accident occurs, the energy absorber is connected between the shaft part and the area of engagement of the belt reel, so that the energy absorber is effective as a load limiter for the vehicle passenger.

The energy absorber is configured so that a relative movement between the shaft part which is, for example, the part on which the safety belt is wound on the belt reel, and the area of engagement with which the blocking apparatus in the belt reel can engage, can take place while consuming energy. This movement is preferably a rotation of the shaft part with respect to the engaging part of the reel blocked on the frame. This movement can be an applied braking in the form of brake bearings or respectively friction bearings acting between the shaft part and the engaging part.

Additionally, one side of the energy absorber is connected to the shaft part upon which a force emanating from the belt web acts, and the other side of the energy absorber engages with the area of engagement of the belt reel to which the blocking apparatus is applied.

The energy consuming relative movement between the shaft part and the area of engagement can, in a preferred manner, take place around the axis of the reel. In a preferred embodiment, the energy absorber is configured as a torsion element, for example in the form of a rod.

To connect the energy absorber between the shaft part and the area of engagement of the reel, a moveable frictional connection element can be provided. This moveable frictional connection element can be configured so that it also produces the frictional connection between the shaft part and the engagement area of the belt reel under normal operating conditions, that is to say below the specific threshold of change of speed of the vehicle. The frictional connection element can be moveable such that it connects the energy absorber between the shaft part and the area of engagement of the belt reel above the threshold of change of speed of the vehicle. Additionally the frictional connection element can be moveable such that one side of the energy absorber is connected to the shaft part or the area of engagement of the belt reel, while the other side of the energy absorber is torsion resistantly connected to the area of engagement or the shaft part.

In a preferred embodiment, one side of the energy absorber is torsion resistantly connected to the shaft part and above the specific threshold of change of speed of the vehicle its other side can be connected by means of the moveable frictional connection element to the area of engagement of the belt reel.

In a preferred manner the movement of the frictional connection element is performed by means of an ignitable propellant gas charge. This propellant gas charge is ignited above the specific threshold for change of speed of the vehicle. The ignition can take place when a further restraining component of the vehicle restraint system, for example an airbag, and/or belt tightener has been actuated. In this case, ignition signals which serve to actuate the further restraining components, in particular airbags, are used for igniting the propellant gas charge for the frictional connection element.

By means of the invention it is further ensured that in connection with a further restraining component, for example the airbag, the forward displacement allowed by the energy absorber does not lead to a risk of energy to the part of the body forwardly displaced, for example the head, as the inflated airbag offers

protection against impact.

In this manner not only is the risk of injury to the area of the body with which the safety belt web is in contact prevented, but also, when additional restraining components such as, for example, an airbag, is used, a relatively long extension of the belt web, that is to say a relatively high degree of energy absorbtion in the belt reel is obtained.

When a belt tensioner is used to tighten the safety belt, the loading upon the points of the body with which the tightened belt is in contact is limited or respectively reduced by the consumption of energy in the belt reel.

An embodiment of the invention is explained with reference to the accompanying drawing.

The drawing shows, partly schematically, a belt roller for a safety belt of an automotive vehicle. A belt reel 1 is mounted rotatably in a frame 8. The belt reel 1 is rotatable about a reel axle 7 for rolling up and unrolling a safety belt, not shown in more detail. The safety belt is fixed in a known way to a shaft part 2. In the case of an excessively fast extension of the belt web, and too great a change in the speed of rotation of the belt reel 1, or when there is too great a change in the speed of the vehicle a blocking apparatus 3 can engage with an area of engagement 4 of the belt reel 1. The area of engagement 4 of the belt reel can be configured as a continuous toothed ring in a known manner. The blocking apparatus 3 can be configured in a known manner as a blocking detent which is supported on the frame 8 and engages in a locking manner between two teeth of the area of engagement. In this way the belt reel is protected from further rotation. In this respect the actuation of the belt roller shown corresponds to known embodiments of belt rollers.

In the embodiment shown, the belt reel is further provided with an energy absorber 5 in the form of a torsion rod. The energy absorber extends coaxially with respect to the reel axle 7 in an axial direction. On one side, the energy absorber is, for example torsion resistantly connected by means of a square part 10 to the shaft part 2 on which the safety belt web can be wound. On the other side, or respectively on the other end of the energy absorber 5 configured as a torsion rod, a frictional

connection element 6 is provided in the form of a sleeve or muff moveable in an axial direction.

Under normal operating conditions, that is to say below a specific threshold for the change of speed of the vehicle or respectively change of speed of rotation of the belt reel 1, a positive and frictional connection is produced between the area of engagement 4 and the shaft part 2 by the frictional connection element 6. Moreover the frictional connection element 6 engages with an expanded part (base 19), for example by means of serrations 11 in correspondingly moulded teeth on the inner side of the shaft part 2. Additionally the serrations 12 provided on the exterior of the sleeve-shaped frictional connection element 6 engage in correspondingly shaped internally located teeth of a wheel 13, which bears the area of engagement 4, in particular in the form of external teeth, on its periphery. By means of this frictional connection which is produced by the frictional connection element 6 between the shaft part 2 and the area of engagement 4, during normal operating conditions of the belt roller the energy absorber is bypassed.

A motive spring 14 engages with the belt reel 1 through a spring housing 15 mounted on the frictional connection element 6 and transfers a restoring force for rolling up the belt web.

The rotary mounting of the side of the belt reel facing the springs is rotatably mounted by means of a projection on the wheel 13 which is mounted in a supporting frame 15 connected to the frame 8. On the other side of the reel (the side facing the mechanism) the rotary mounting of the belt reel can be done in a known manner, for example by means of a cap 16 supported on the frame 8.

The frame 8 can be connected in a positive and frictional manner to the vehicle structure, for example in the area of the B column or at another suitable point by means of a screw connection inserted through a fixing aperture 17. A propellant gas charge 9, which is electrically ignitable by means of electrical supply leads 18, serves to bring about the axial displacement of the frictional connection element 6 when the specific change of speed threshold is exceeded, for example during an accident. When the propellant charge 9 is ignited a propellant gas is produced by means of which the sleeve-shaped frictional connection element 6 is moved in an axial direction, to the

right according to the drawing. In this case the expanded part (base 19) and the serrations 11 provided thereon disengage from the shaft part 2 and move completely into an annular recess 20 in the wheel 13. The frictional connection element is thereby uncoupled from the shaft part 1, however it remains, by means of its serrations 12, frictionally connected to the wheel 13 which carries the area of engagement 4 for the blocking apparatus 3 on its periphery. Furthermore, there is a frictional connection between the inside of the sleeve-shaped frictional connection element 6 and one side of the energy absorber 5. This frictional connection can only be produced by displacement. It can, however, also be present during norma operating conditions and be retained during the axial displacement of the frictional connection element 6. During the axial displacement, frictional connection element 6 can also still move inside the spring casing 21 in an axial direction. An appropriate recess 23 is provided in a cover 22 for the spring cassette to allow the axial displacement of the frictional connection element 6.

The frictional rotary connection between the sleeve-shaped frictional connection element 6 and the energy absorber 5 can also be done by serrations which form a rotary connection but allow the axial displacement of the sleeve-shaped frictional connection element 6.

When, as described above, the base 19 is located in the recess 20 of the wheel 13 after displacement of the frictional connection element 6 to the right according to the drawing, the energy absorber 5 is activated. When a force acts on the shaft part 2 by means of the belt web, the shaft part 2 rotates with respect to the blocked wheel 13, wherein by torsion of the energy absorber 5 energy is absorbed. When there is relative rotation of the shaft part 2 with respect to the blocked wheel 13, one side of the energy absorber 5 is torsion resistantly connected to the shaft part 2, in the embodiment shown by means of the square 10. The other side of the energy absorber 5 is torsion resistantly connected to the blocked wheel 13 by means of the frictional connection element 6 displaced to the right. In this way a load limit for the body of the vehicle passenger which moves against the belt web connected to the shaft part 2 is brought about.

The ignition of the propellant charge 9 can occur at the same time as the

actuation of an airbag 24 which is assigned to the same seat as the belt roller. In connection with such an airbag, a relatively large extension of the belt web connected to the shaft part 2 is brought about, and because of the relatively high degree of energy absorbed thereby in the energy absorber 5, a low loading upon the body of the vehicle passenger occurs. The risk of injury is reduced to a minimum by the cooperation of the belt roller shown with the actuation, that is to say the inflated airbag 24. In the drawing the airbag 24 is shown schematically. In addition it is shown schematically that by means of one ignition signal 25 the airbag as well as the propellant charge 9 is ignited.

CLAIMS

1. A belt roller for a safety belt of an automotive vehicle, with a belt reel for the safety belt, a frame which can be frictionally connected to the structure of the motor vehicle, on which frame the belt reel is rotatably mounted and a blocking apparatus which, when there is an excessive change of speed of the vehicle, is effective by engagement between the frame and the belt reel, wherein between a shaft part of the belt reel upon which forces emanating from the belt web act, and an area of engagement of the belt reel with which the blocking apparatus can engage, an energy absorber is provided, which allows a specific extension of the belt web with simultaneous absorption of the energy transferred from the belt web.

2. A belt roller according to claim 1, wherein below a specific threshold of change of speed of the vehicle, the energy absorber is bypassed by direct frictional connection between the shaft part and the area of engagement, and above the specific threshold can be connected between the shaft part and the area of engagement.

3. A belt roller according to claim 1 or claim 2, wherein a moveable frictional connection element produces the direct frictional connection between the shaft part and the area of engagement on the belt reel.

4. A belt roller according to any one of claims 1 to 3, wherein the energy absorber can be connected between the shaft part and the area of engagement of the belt reel by means of a moveable frictional connection element.

5. A belt roller according to any one of claims 1 to 4, wherein the same frictional connection element is provided for both the direct frictional connection between the shaft part and the area of engagement on the belt reel and the connection of the energy absorber between the shaft part and the area of engagement.

6. A belt roller according to any one of claims 1 to 5, wherein when there is a

rotation of the shaft part with respect to the area of engagement of the belt reel blocked on the frame, the energy absorber connected between the shaft part and the area of engagement of the belt shaft absorbs energy transferred to the shaft part from the belt web.

7. A belt roller according to any one of claims 1 to 6, wherein one side of the energy absorber is torsion resistantly connected to the shaft part and the other side can be positively connected to the area of engagement of the belt reel by means of the moveable frictional connection element.

8. A belt roller according to any one of claims 1 to 7, wherein the energy absorber is arranged coaxially with respect to the reel axle and the frictional connection element is displaceable in an axial direction.

9. A belt roller according to any one of claims 1 to 8, wherein the energy absorber is configured as a torsion element.

10. A belt roller according to claims 8 and 9, wherein that the frictional connection element is configured as a sleeve which surrounds one end of the energy absorber which is configured as a torsion rod.

11. A belt roller according to any one of claims 1 to 10, wherein the frictional connection element is moveable by means of an ignitable propellant charge for connecting the energy absorber between the shaft part and the engagement area of the belt reel.

12. A belt roller according to claim 11, wherein the propellant gas charge can be ignited as a result of the actuation of at least one further restraining apparatus of the automotive vehicle restraint system.

13. A belt roller according to claim 12, wherein the further restraining apparatus

is an airbag assigned to the same vehicle seat as the seat roller.

14. A belt roller according to claim 12, wherein the further restraining apparatus is a belt tensioner which tightens the safety belt.

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15. A belt roller for a safety belt of an automotive vehicle substantially as hereinbefore described and illustrated with reference to the accompanying drawing.

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report)	Application number GB 9520991.2
Relevant Technical Fields (i) UK Cl (Ed.N) A3V (VRJ, VRQ) (ii) Int Cl (Ed.6) B60R 22/28	Search Examiner D BUCKLEY Date of completion of Search 12 DECEMBER 1995
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) ONLINE: WPI	Documents considered relevant following a search in respect of Claims :- 1 TO 15

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Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 1440232	(KANGOL-TEKA) see eg Claim 1	1 at least
X	GB 1354804	(FORD MOTOR CO) see whole document	1 at least
X	GB 1144745	(PACIFIC SCIENTIFIC) see, eg, lines 17 to 93 of page 3	1 at least
X	EP 0297537	(NIPPON SEIKO K. K.) see line 54 of column 4 to line 11 of column 5	1 at least
X	US 4158403	(PETER) see line 35 of column 2 to line 7 of column 3	1 at least
X	US 3790099	(ALLIED CHEMICAL) see line 53 of column 2 to line 41 of column 3	1 at least

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