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(54) Drive device for operating a vehicle door

(57) The invention relates to a drive device (3) for operating the vehicle door (2), in particular the tailgate (2), of a motor vehicle (1), which comprises an actuator (4) and two connecting devices (5, 6; 5') provided for connecting the actuator (4) to the vehicle door (2) and to the body (7) of the motor vehicle (1), the actuator (4) having a tubular housing (8) comprising an electromechanical drive and/or a mechanical gear, and an active element (9), which can be moved telescopically out of the housing (8) in the direction of the longitudinal axis (15) of the actuator (4), for operating the vehicle door (2).

In order to avoid or substantially to reduce the transmission of the vibrations (structure-born noises), produced in particular by the motor or the gear of the actuator (4) to the body (7) of the vehicle (1) in a simple manner, the invention proposes, to mount the actuator (4) elastically between the connecting devices 5, 6; 5').

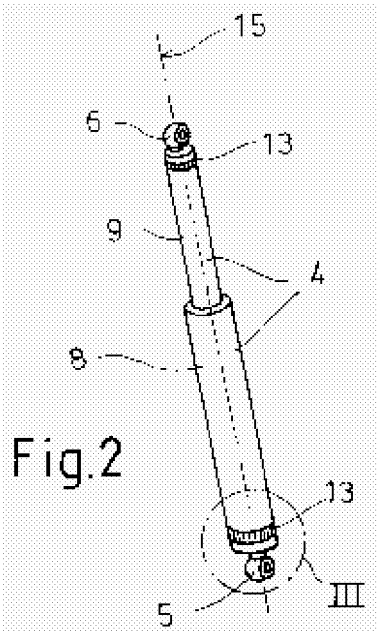

Fig.2

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Description

[0001] The invention relates to a drive device for operating the vehicle door, in particular the tailgate, of a motor vehicle, which comprises an actuator and two connecting devices provided for connecting the actuator on the one hand to the vehicle door and on the other hand to the body of the motor vehicle, the actuator having a tubular housing comprising an electromechanical drive and/or a mechanical gear, and an active element, which can be moved telescopically out of the housing in the direction of the longitudinal axis of the actuator, for operating the vehicle door.

[0002] A known drive device of this type serves in particular to open and close the tailgate of a motor vehicle and has the external form of a gas-filled spring. In this case, an electric motor is situated in the housing of the actuator. The electric motor is operatively connected to the active element via a spindle mechanism and, in order to connect the actuator to the tailgate on the one hand and to the vehicle body on the other hand, respective angle joints are provided for both at each end of the actuator .

[0003] A disadvantage of this known drive device is that vibrations from the motor and gear are transmitted via the housing and the active element directly to the vehicle body or to the tailgate, and, when a drive device of this type is fixed on the body of the vehicle or to the tailgate, the acoustically perceptible level which is already present due to other components of the vehicle rises further.

[0004] The invention is based on the object of providing a drive device for operating a vehicle door, in which a transmission of the vibrations (structure-borne noise) produced in particular by the motor or the gear of the actuator to the body of the vehicle or to the tailgate is avoided in a simple manner or is substantially reduced.

[0005] This object is achieved according to the invention by the features of Claim 1. Further particularly advantageous refinements of the invention are disclosed by the dependent claims.

[0006] The invention is essentially based on the concept of mounting the actuator elastically between the connecting devices, creating thus damping barriers between the actuator on the one hand and the vehicle door and the body of the vehicle on the other hand. Such damping barriers prevent efficiently the transmission of unwanted vibrations created by the actuator to the vehicle body and /or the vehicle door.

[0007] The elastic element here can be composed, for example, of rubber, a flexible plastic (generally a commercially available thermoplastic elastomer which is also referred to below as TPE elastomer), a multi-layer material, as described, for example, in DE 102 60 050 A1, or a compressed, compression-moulded knitted metal fabric (similar to a metallic scouring pad).

[0008] In a first embodiment of the invention, it is provided that the respective connecting device has, on its outer circumference, an annular recess in which at least one, preferably two elastic elements spaced apart axially from each other are arranged in such a manner that a gap-shaped recess remains between the two elastic elements. That end of the actuator which faces the connecting device has an end region which has a radial profile directed towards the longitudinal axis of the actuator, and engages in the gap-shaped recess between the two elastic elements. In this case, the elastic elements and the mutually facing parts of the connecting device and of the actuator are designed in such a manner that no direct contact takes place between the actuator and the respective connecting device.

[0009] In a further embodiment, in which the connecting device is the ball socket of an angle joint, the ball socket is designed as two shells, with the elastic element being positioned between the outer and the inner ball shell.

[0010] Further details and advantages of the invention emerge from the following exemplary embodiments explained with reference to figures, in which:

Fig. 1 shows a schematic perspective view of the rear region of a motor vehicle with an open tailgate and two drive devices according to the invention arranged at the sides;

Fig. 2 shows an enlarged illustration of one of the two drive devices according to the invention, which are only illustrated schematically in Fig. 1;

Fig. 3 shows an enlarged illustration, part of which is reproduced in section, of the region denoted in Fig. 2 by III, with one possible arrangement of an elastic element for insulation of the structure-borne noise being illustrated, and

Fig. 4 shows a view corresponding to Fig. 3 of a further possible arrangement of an elastic element for the insulation of structure-borne noise.

[0011] In Fig. 1, 1 refers to a motor vehicle which has a tailgate 2 which can be pivoted by two drive devices 3 according to the invention from a closed position into the open position illustrated in Fig. 1 and, if appropriate, into the closed position again. The tailgate 2 may also be pivoted by only one drive device 3.

[0012] The drive devices 3 each comprise an actuator 4 and two connecting devices 5, 6 via which the actuator 4 is connected on the one hand to the body 7 of the motor vehicle 1 and on the other hand to the tailgate 2.

[0013] The respective actuator 4 comprises a tubular housing 8 in which there is an electric motor drive (not illustrated) comprising an electric motor and a step-up gear connected downstream thereof. A spindle drive (likewise not illustrated) is connected to the output shaft of the electric motor drive and acts on an active element 9 (for example the spindle nut of tubular design) which can be pushed out of the housing 8 and into the latter telescopically.

[0014] The connecting devices 5, 6 essentially com-

prise the ball socket 10 of an angle joint 11 in which a ball-ended pin 12 fixed either to the body 7 or to the tailgate 2 is pivotably mounted with the ball socket 10 (Fig. 3).

[0015] The invention makes provision for an elastic element 13 (merely indicated as black rings in Figs. 1 and 2) to be arranged between the respective connecting device 5, 6 and the actuator 4, so that the actuator 4 is mounted elastically and, owing to this elastic mounting, vibration energy from the actuator 4 does not pass to the body 7 of the motor vehicle 1 or is at least significantly reduced.

[0016] As can be gathered from Fig. 3, the first connecting device 5 has, on the outside, on its side facing the housing 8 of the actuator 4, an annular recess 14 in which one, preferentially two elastic elements 13', 13", for example of a TPE elastomer, are arranged in a manner defining a gap 14'. A radial directed end 16 either of the housing 8 or of the active element 9 of the actuator 4 is received in this gap 14' and engages without touching the wall 17 of the recess 14.

[0017] To facilitate the assembly of the two elastic elements 13', 13" with the actuator 4, it might be useful to provide an actuator 4 with two complementary parts to form the recess 14.

[0018] The entire arrangement accommodating the elastic elements 13' and 13" is covered by a protective cap 18 of plastic, with sealing rings 19, 20 being provided to protect the elastic elements 13', 13" from moisture. The protective cap 18 preferably likewise has elastic properties and permits deformations.

[0019] In order to optimally use the properties of the elastic elements 13-13", their damping characteristic is to be selected to reduce efficiently the frequency range in particular between 100 and 5000 Hz.

[0020] Fig. 4 shows a further exemplary embodiment of a drive device according to the invention. The connecting device here is essentially again the ball socket 10' of an angle joint 11', the ball socket 10' of the angle joint 11' being fixed on the actuator (not illustrated) and the ball-ended pin 12' being fixed on the body of the motor vehicle. In this exemplary embodiment, the ball socket 10' comprises an inner ball socket 22 directly surrounding the swivel ball 21, and an outer ball socket 23 which is spaced apart from the inner ball socket 22 and is connected to the actuator, the elastic element 13 being arranged between the inner and the outer ball sockets 22 and 23.

[0021] In Fig. 4, the reference number 24 denotes a securing ring cooperating with a groove (not shown) and the reference number 25 an annular seal for sealing the elastic element 13. The material for the elastic element 13 can once again be a TPE elastomer or else a compressed and compression-moulded knitted metal fabric. These materials have both elastic (resilient) and damping properties, the damping reducing the force transmission and therefore the excitation of the connecting devices and then, reducing vibrations frequencies.

[0022] Of course, the invention is not restricted to the exemplary embodiment described above. For example, the arrangements accommodating the elastic elements may be provided with stops which prevent overloading of the elastic element. In addition, the drive device according to the invention can be used, for example, also to operate the side doors of a motor vehicle.

[0023] Furthermore, the connecting devices of the drive device do not absolutely have to be angle joints.

Claims

1. Drive device for operating the vehicle door (2), in particular the tailgate (2), of a motor vehicle (1), which comprises an actuator (4) and a first connecting device (5 ; 5') for connecting the actuator (4) to the vehicle door (2) and a second connecting device (6) for connecting the actuator (4) to the body (7) of the motor vehicle (1), **characterized in that**, in order to avoid the structure-borne noise produced by the actuator (4) being passed either on to the body (7) of the motor vehicle (1) or on the vehicle door, at least one elastic element (13, 13', 13") is provided between each connecting device (5, 6; 5') and the actuator (4).

2. Drive device according to Claim 1, **characterized in that** the elastic element (13, 13', 13") is composed of rubber or a flexible plastic.

3. Drive device according to Claim 1, **characterized in that** the elastic element (13, 13', 13") is a compressed, compression-moulded knitted metal fabric.

4. Drive device according to one of Claims 1 to 3, **characterized in that** the connecting device (5) is provided with an annular recess (14) and in which at least one, preferably two elastic elements (13', 13") are arranged in a manner defining a gap for receiving a radial directed end (16) either of a housing (8) or of the active element (9).

5. Drive device according to one of Claims 1 to 4, **characterized in that** the connecting device (5') comprises the ball socket (10') of an angle joint (11'), the ball-ended pin (12') of which is connected either to the body (7) of the motor vehicle (1) or to the vehicle door (2), and **in that** the ball socket (10') comprises an inner ball socket (22) directly surrounding the swivel ball (21) of the ball-ended pin (12'), and an outer ball socket (23) which is spaced apart from the inner ball socket (22) and is connected to the actuator (4), the elastic element (13) being arranged between the inner ball socket (22) and the outer ball socket (23).

6. Drive device according to one of Claims 1 to 5, **char-**

acterized in that the tubular housing (8) comprises an electromechanical drive and/or a mechanical gear, and the active element (9), which can be moved telescopically out of the housing (8) in the direction of the longitudinal axis (15) of the actuator (4), for operating the vehicle door (2).

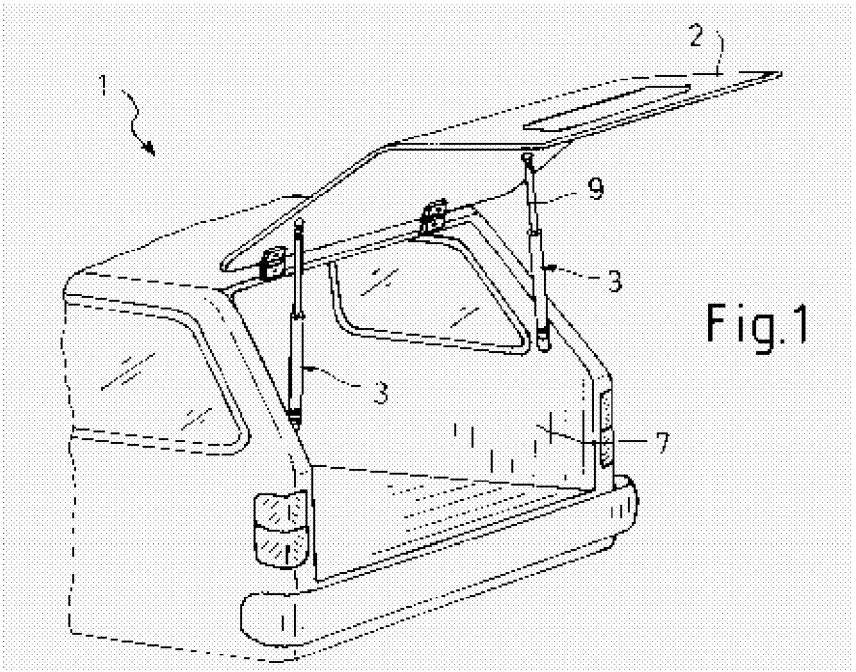

Fig.1

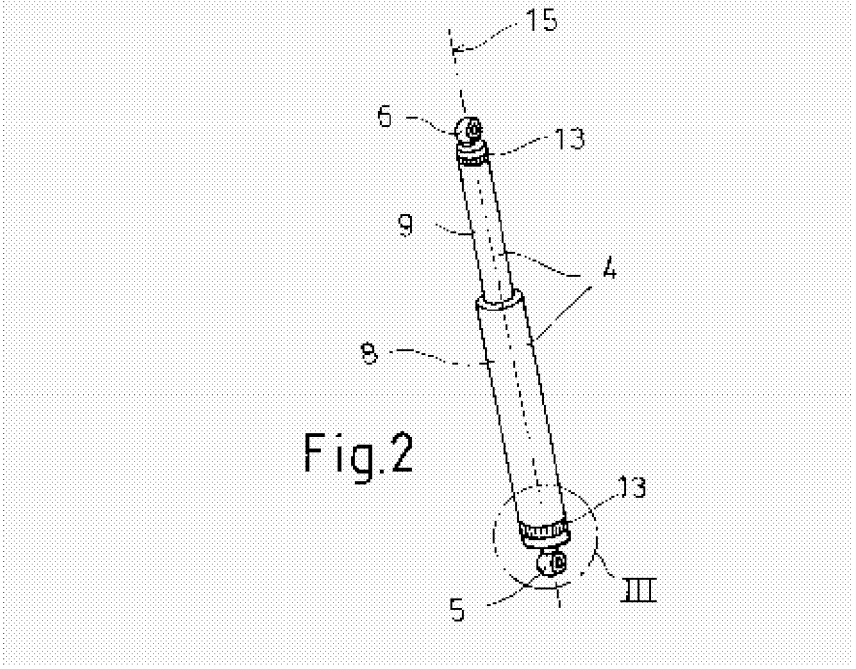

Fig.2

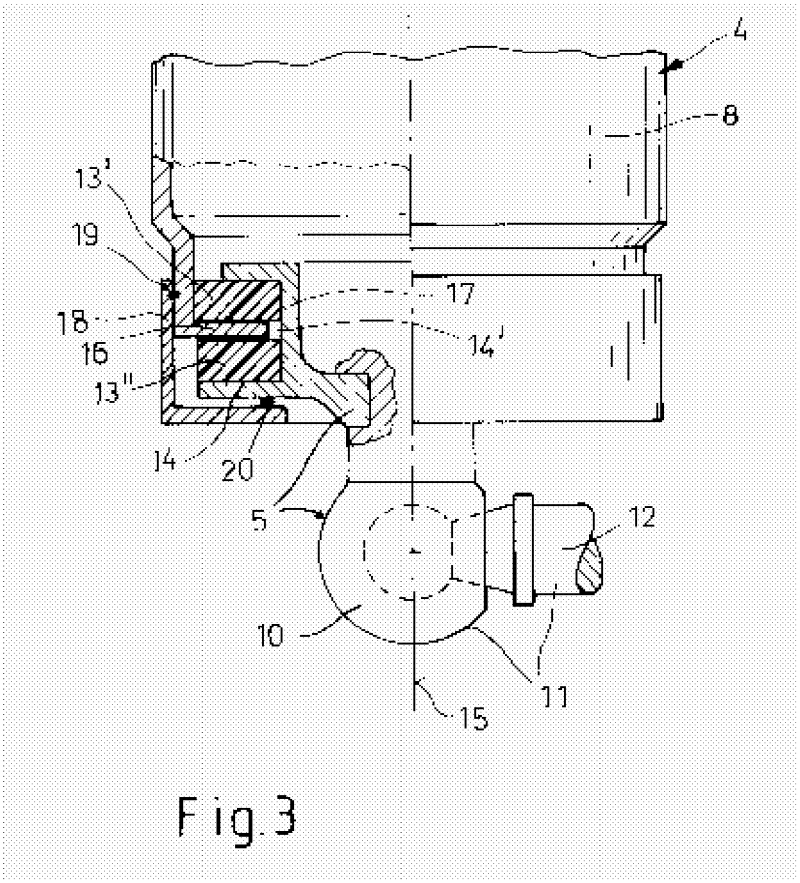

Fig. 3

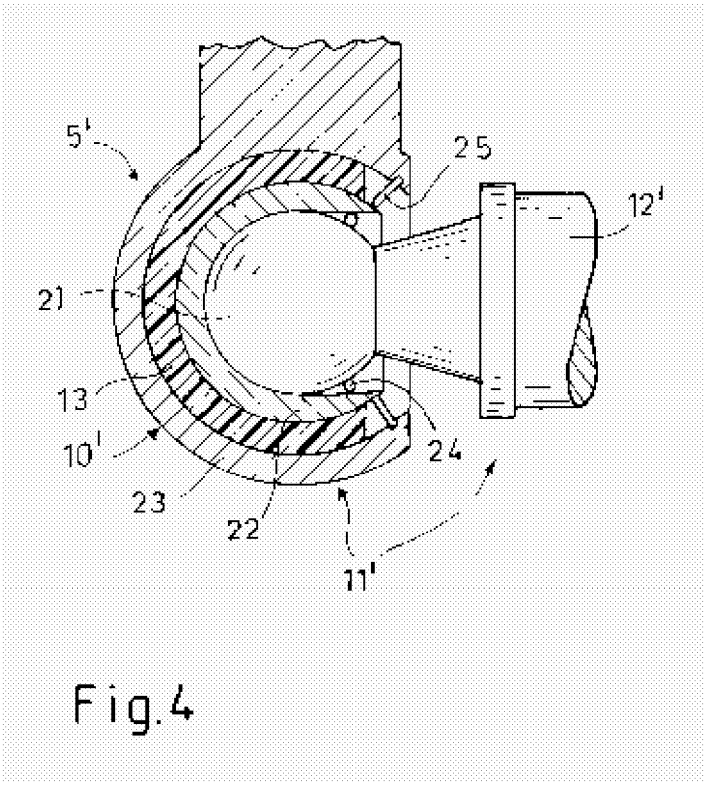

Fig.4

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EUROPEAN SEARCH REPORT

Application Number
EP 07 10 7255

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 20 2006 007739 U1 (KIEKERT AG [DE]) 5 October 2006 (2006-10-05) * paragraphs [0016], [0033], [0043]; figures 1,7 *	1,2,5,6	INV. E05F15/12
A	US 6 520 038 B1 (PFANZER GERHARD [DE]) 18 February 2003 (2003-02-18) * column 2, line 54 - column 3, line 58; figures 5-7 *	1,2,4	

TECHNICAL FIELDS SEARCHED (IPC)

E05F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	8 October 2007	WITASSE-MOREAU, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 10 7255

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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08-10-2007

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US 6520038 B1	18-02-2003	DE 19849245 C1	20-04-2000
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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