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F2S SBD S103
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(54) Abstract Title
Damping device

(57) The damping device for a component 15 pivotable between two end positions has a viscous brake 23 for decelerating the pivoting movement, which brake 23 has a braking wheel 24 and a driving element 29 which engages tangentially thereon, said braking wheel 24 and driving element 29 moving relative to one another as the component 15 pivots, thus causing the braking wheel 24 to rotate.

One of the braking wheel 24 and driving element 29, is arranged in a stationary manner and the other is arranged on a lever 26 articulated to the component 15, and the articulation point 27 is situated in such a way that the displacement travel which is covered by the lever 26 in each case within a constant pivot angle of the component 15 increases as the pivot travel of the component 15 proceeds from its first end position to the second end position.

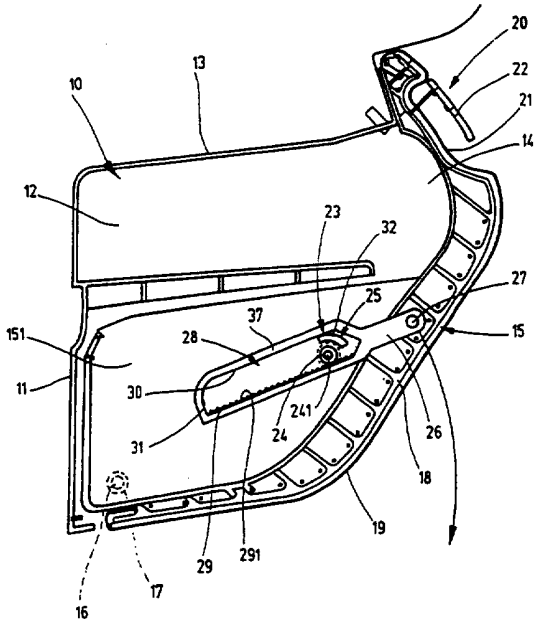

Fig.1

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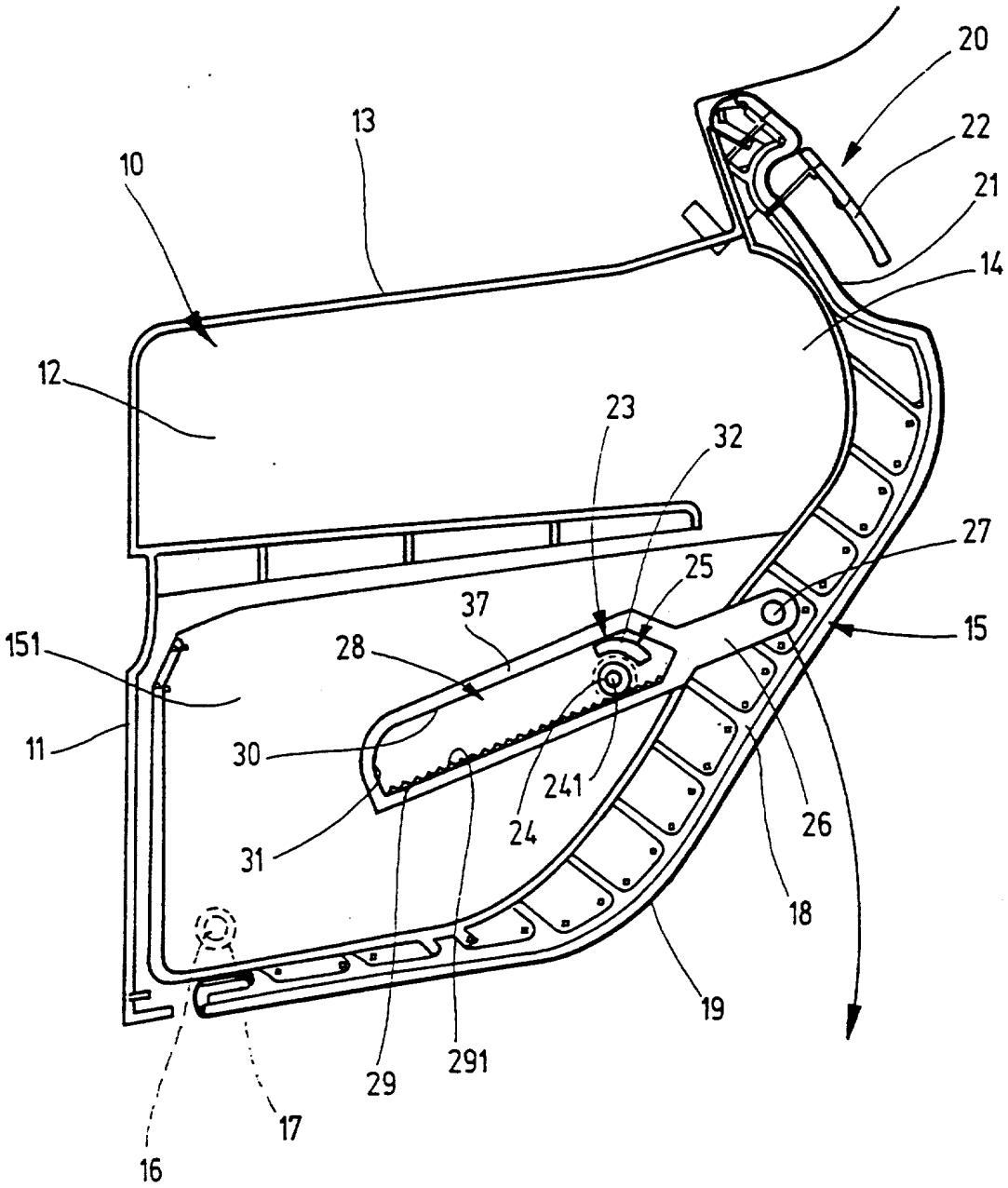
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Fig.1

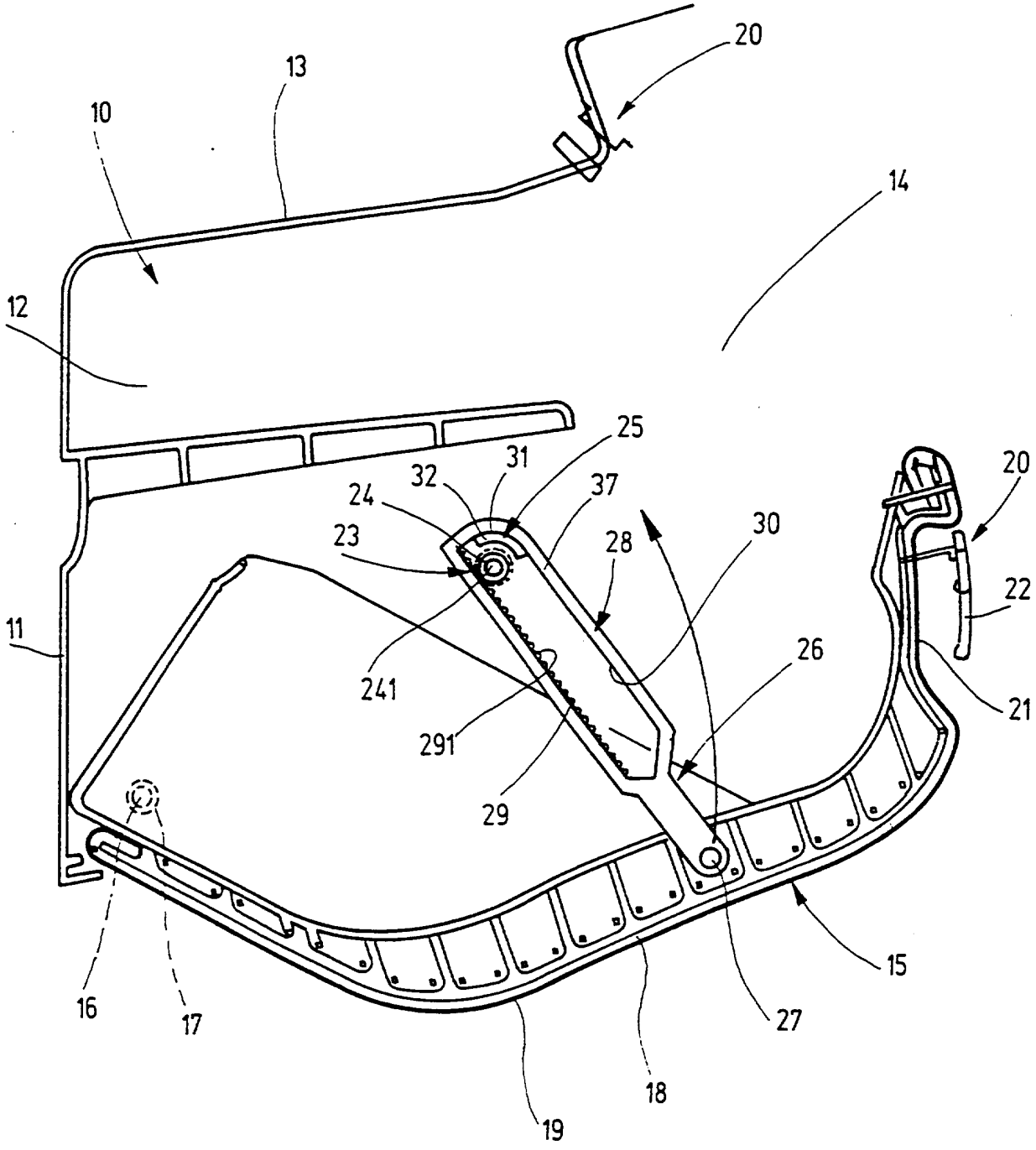
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Fig. 2

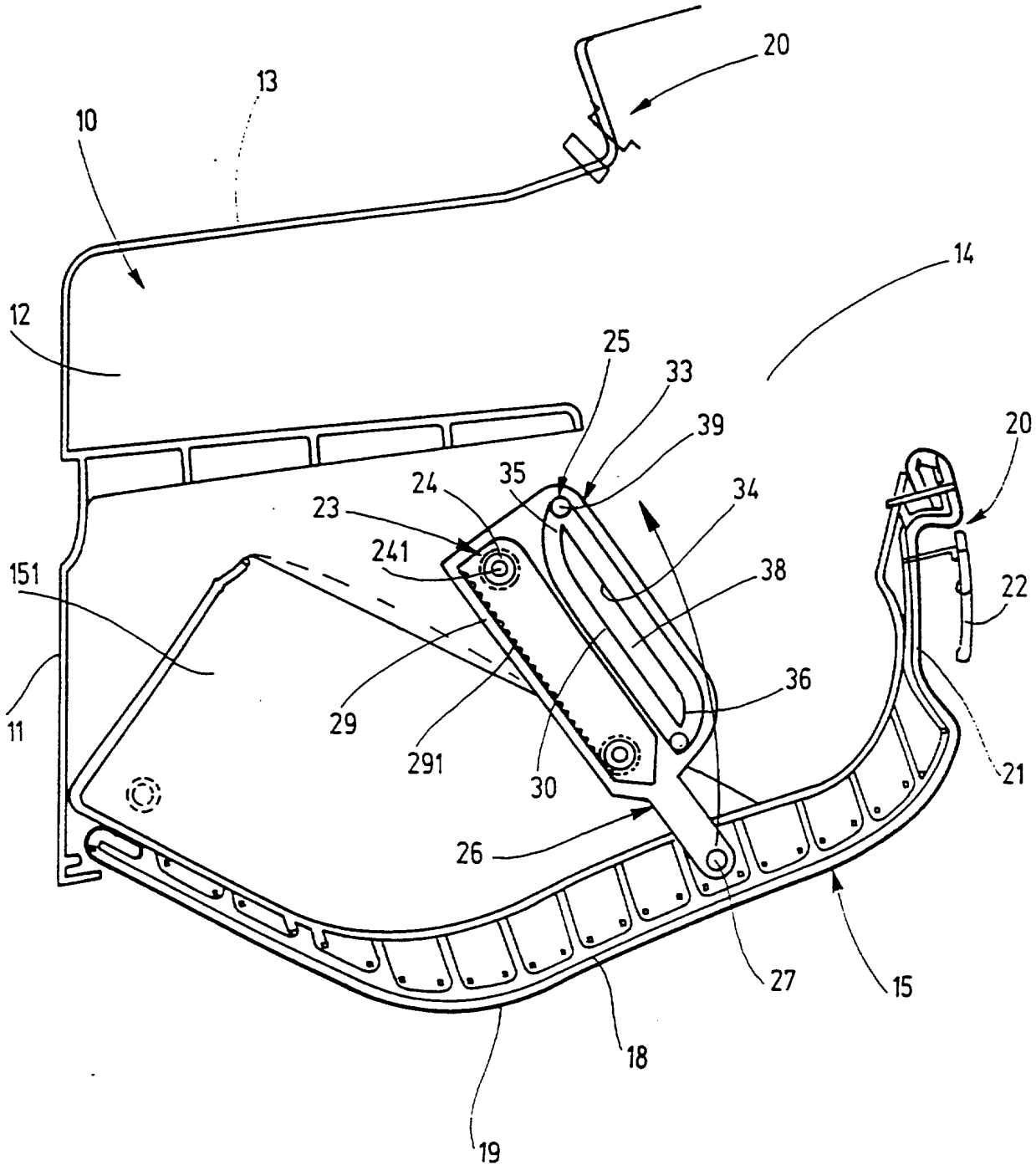
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Fig. 3

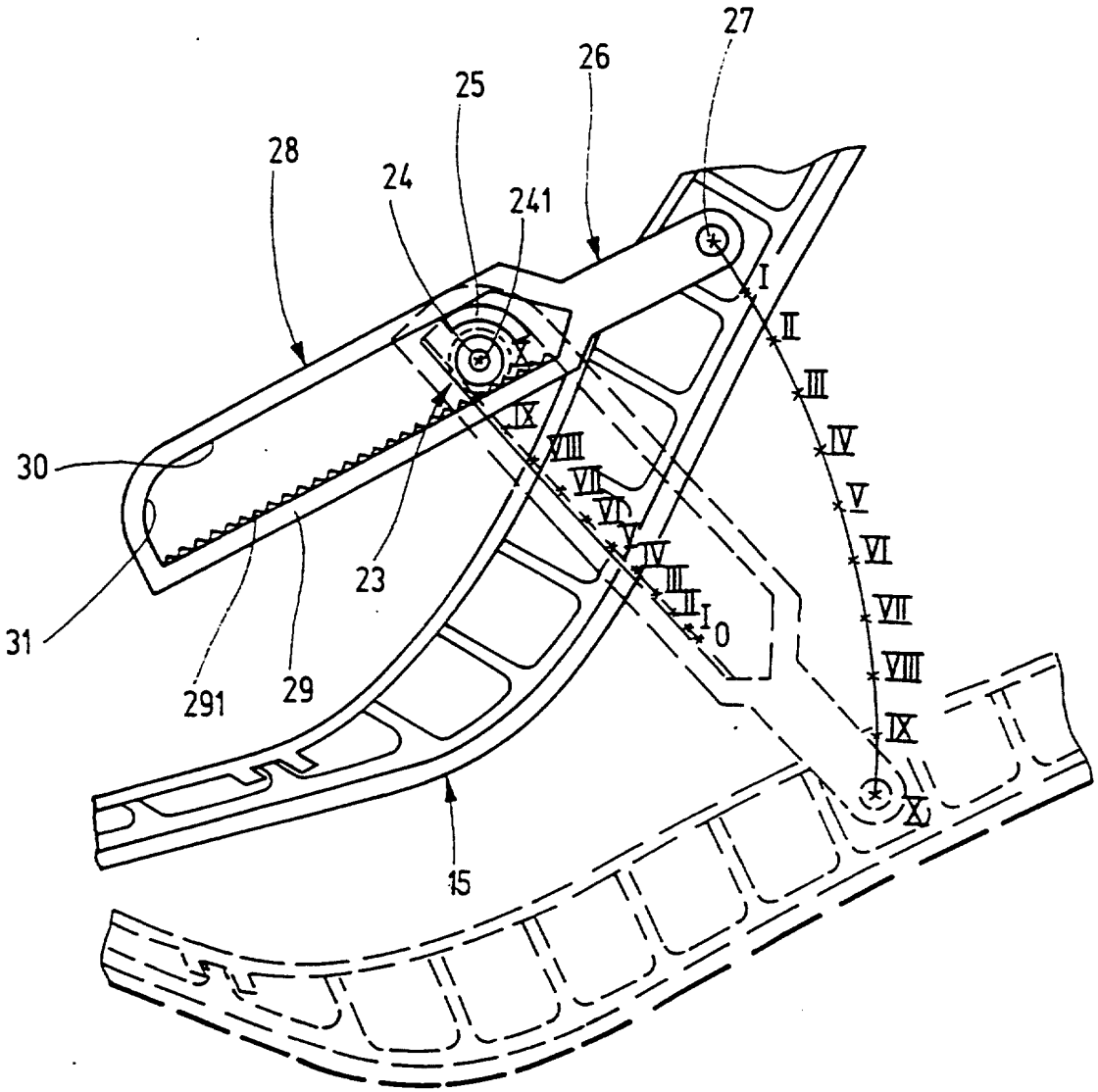

Fig. 4

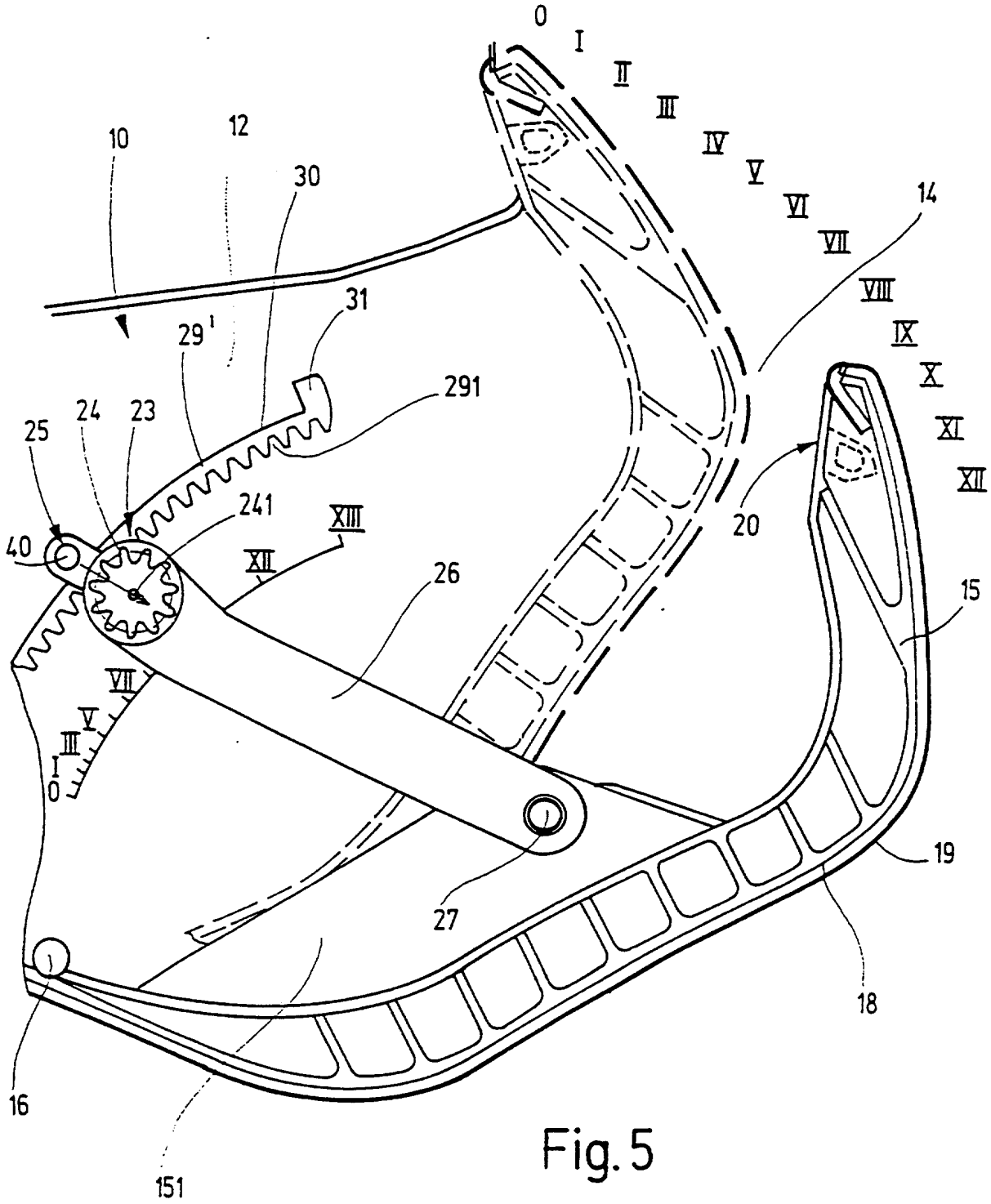
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Fig. 5

Damping device

The invention relates to a damping device for a component pivotable between two end positions and having a viscous brake for decelerating the pivoting movement, which brake has a braking wheel and a driving element which engages tangentially thereon, said braking wheel and driving element moving relative to one another as the component pivots, thus causing the braking wheel to rotate.

Such pivotable components are represented in the car industry, for example, by closure flaps of glove compartments or other storage compartments or receptacles or of accessories which can pivot out to be used to increase the convenience for the user, for example drinking vessel holders, ashtrays and the like.

A known container, such as an ashtray, storage compartment or the like, which can be inserted into an installation opening in the interior of a vehicle (DE 195 10 749 C1) has a housing with a housing opening and a lid for closing off the housing opening, which lid can be pivoted out of a closed position into an open position and vice versa. For this purpose, the lid is attached laterally to two pivot arms which are rotatably mounted on, in each case, one of two side walls of the housing situated opposite one another. The lid can be locked in its closed position, and after its opening spring has been released it can be moved into its open position. Two viscous brakes which respectively engage on each side of the lid ensure here that the opening movement is damped, and prevent the hard impact of the lid against a stop which determines its open position. Each viscous brake has a pinion which is rotatably mounted on the two housing side-walls, and an arcuate toothed segment which intermeshes with said pinion and is formed at the free end of the pivot arm which protrudes beyond the centre of rotation. The two viscous brakes generate a braking torque which is constant over the pivot travel of the lid and which ensures a steady movement of the lid only in conjunction with the linear spring characteristic of the opening spring. Since the spring force decreases linearly over the pivot travel, it is reduced at the end of the pivot travel to such an extent that a gentle impact of the lid against the stop is ensured. In the case of pivotable lids such as the closure flaps of glove compartments which, after they have been released, go automatically into their open position under the force of gravity, the high braking torque at the start of the opening movement is disruptive,

and at the end of the opening movement it is not sufficiently high to ensure that the lid slides gently into its end position.

The present invention seeks to implement a damping device of the type mentioned at the beginning with the cost-effective visco-damping elements, also referred to as silicone brakes, which has progressive damping characteristics, i.e. its damping effect increases over the pivot travel of the component.

According to the present invention there is provided a damping device for a component pivotable between two end positions and having a viscous brake for decelerating the pivoting movement, which brake has a braking wheel and a driving element which engages tangentially thereon, said braking wheel and driving element moving relative to one another as the component pivots, thus causing the braking wheel to rotate, wherein, of the braking wheel and the driving element, one is arranged in a stationary manner and the other is arranged on a lever which is articulated to the component, and the articulation point of the lever on the component is situated in such a way that the displacement travel which is covered by the lever in each case within a constant pivot angle of the component increases as the pivot travel of the component proceeds from its first end position to the second end position.

The damping device according to the invention has the advantage that the introduction of the lever and the arrangement of the lever articulation point on the pivoting component in the specified manner cause the pivoting movement of the component out of its first end position to take place in a completely unbraked, or virtually unbraked, manner, and then to take place with an increasing degree of braking with maximum braking torque at the end. This ensures, on the one hand, undelayed rapid initiation of the pivoting movement, in particular under the force of gravity, and, on the other hand, hard braking when the second end position is reached, which braking ensures that the component slides gently into its end position. The change in braking torque of the viscous brake is brought about here by means of the inventive conversion of identical pivot travel sections of the component into continuously increasing displacement sections of the lever, as a result of which, assuming a uniform pivoting movement of the component, the relative speed between the braking wheel and driving element rises, and thus the rotational speed of the braking wheel increases. Since the braking torque of the viscous brake depends on the rotational speed of the

braking wheel, the braking torque rises as the pivot travel of the component proceeds. This applies only to the pivoting movement of the component out of its first end position into its second end position.

The inventive introduction of the lever also provides the possibility of displacing a stop, which defines the second end position of the component, away from the component towards the lever, providing greater freedom for the design of the component.

Preferred embodiments of the damping device according to the invention with advantageous developments and improvements of the invention are specified in the further patent claims.

According to a preferred embodiment of the invention, the driving element is assigned a guide track which extends parallel to it, and the braking wheel is assigned a guide element which is arranged at a radial distance from its axis of rotation and which is supported on the guide track, the guide element and guide track being arranged and aligned in such a way that the braking wheel and driving element are held in mutual engagement. This structural measure ensures that, over the entire pivot travel of the component out of its first end position into the second end position, the drive connection between the driving element and braking wheel is maintained independently of the movement kinematics of the lever.

According to one preferred embodiment of the invention, a free-wheeling or decoupling device which is active during the pivoting-back travel of the component out of its second end position into its first end position is provided which eliminates the drive connection between the braking wheel and driving element. Such a decoupling device makes it possible to make the component, which has to be reset manually from its second end position into its first end position, significantly more convenient to use since the operator does not have to perform the resetting operation counter to the braking effect of the viscous brake. The detachment of the braking wheel and driving element from one another permits the component to pivot in an easily moving fashion which creates a pleasant sensation, which is of particular importance when the component is designed as the closure flap of a glove compartment.

Such a free-wheeling or decoupling device can be implemented in a structurally easy fashion if, in accordance with one advantageous embodiment of the

invention, a second guide track is provided for the guide element, which second guide track runs along the first guide track at such a parallel distance that when the guide element rests on the second guide track the braking wheel and driving element are disengaged. The first and second guide tracks are connected to one another at their two ends by means of one diverter in each case, in such a way that the guide element inevitably changes over to the respective other guide track.

The invention is explained below in more detail with reference to preferred embodiments illustrated in the drawings, in which:

Fig. 1 shows a cross-section of a glove compartment, closed by means of a closure flap, for the interior of a vehicle,

Fig. 2 shows an identical view to that in Fig. 1 with the glove compartment opened,

Fig. 3 shows an identical view to that in Fig. 2 with a modified closure flap,

Fig. 4 shows an enlarged view of a portion of the closure flap in Figs. 1 and 2 in the closed and open positions,

Fig. 5 shows a portion of a cross-section of a glove compartment with a closure flap in accordance with a further embodiment.

The glove compartment 10, which is illustrated in cross-section in Fig. 1 and is integrated into the dashboard of a vehicle, is bounded by a rear wall 11, two side walls 12 situated opposite one another, and an upper terminating wall which joins the rear wall 11 and side walls 12, and clears a housing opening 14 to the interior of the vehicle. The housing opening 14 can be closed off by means of a closure flap 15, which is held pivotably on the side walls 12 and at the same time forms the lower terminating wall 13 of the glove compartment. For this purpose, the closure flap 15 engages, with two pivot pins 16 which each protrude at a right angle from the side parts 151 of said flap 15, into corresponding receiving holes 17 in the side walls 12. The closure flap 15 which, in the closed position, extends from the front edge of the upper terminating wall 13 as far as the lower edge of the rear wall 11 is lined on its upper side with a foamed material 18 with closed-cell outer skin 19 or a separate coating, and is detachably locked to the upper terminating wall 13 by means of a locking mechanism designated in its entirety by 20. The release button 22, which is arranged in a depression 21 in the closure flap 15, can be actuated manually in order

to release the locking mechanism 20.

After the release button 22 has been actuated, the closure flap 15 drops, under the force of gravity, into its open position (illustrated in Fig. 2), in which it completely clears the housing opening 14. In order to produce a steady, gentle pivoting movement into its open position without hard impact, the pivoting movement of the closure flap 15 is damped by means of a viscous brake 23. Such viscous brakes or visco-damping elements or silicone brakes are commercially available as small-volume, inexpensive components. In a visco damping element, there is a toothed pinion 24 protruding in a known manner from its housing, which pinion 24 is held in the housing so as to rotate about an axis of rotation 241, and in said housing it experiences, during its rotation in the viscous fluid, a braking torque which rises as the rotational speed of the toothed pinion 24 increases. The viscous brake 23 is attached to the side wall 12 of the glove compartment 10 by its housing, of which Figs. 1 and 2 show only an arc segment 32, which is moulded onto the housing and forms a guide element 25. A lever 26, which is secured to the closure flap 15 so as to pivot at the fulcrum 27, engages with a continuous bracket 28 around the toothed pinion 24 and the guide element 25 or arc segment 32. One bracket arm is designed as a toothed bar 29, whose toothing 291 inter-meshes with the toothed pinion 24, while the bracket arm situated opposite constitutes a guide rack 37 with a guide track 30, which is formed thereon, is situated opposite the toothing 291 and bears against the guide element 25, and thus keeps the toothed pinion 24 in engagement with the toothing 291. At the end of the bracket 28 remote from the fulcrum, the two bracket arms are connected to one another by means of an arcuate cross web, which constitutes a stop 31 and determines the open position of the closure flap 15 by bearing against the guide element 25. The position of the fulcrum 27 of the lever 26 and the position of the toothed pinion 24 are now defined in such a way that at the start of the opening movement of the closure flap 15 the relative movement of the toothed bar 29 at the tooth engagement of the viscous brake 23 is approximately zero, with the result that the closure flap 15 can be set in motion without damping, or with minimum damping. As the pivot travel of the closure flap 15 progresses, the relative movement of the toothed bar 29 with respect to the toothed pinion 24 increases continuously with the same pivot travel or pivot angle, with the result that the rotational speed of the toothed pinion 24, and thus the braking torque

generated by the viscous brake 23, rises, said braking torque reaching its maximum at the end of the pivoting movement and ensuring that the stop 31 comes to rest gently on the guide element 25. In order to illustrate the method of operation of the viscous brake 23, Fig. 4 shows an enlarged portion of the movement of the closure flap 15 and lever 26 when the glove compartment is being opened, the closure flap 15 being illustrated extended into the closed position and by dot-dash lines in the open position. The pivot travel of the closure flap 15 is divided into ten equal pivot angles or pivot travel sections and designated by the numerals 0 - X. The displacement position reached by the lever 26 in each pivot position 0 - X of the closure flap 15 is designated by the same numerals 0 - X. It is clear that, as the pivot travel of the closure flap 15 proceeds, the displacement travel of the lever 26 covered between two displacement positions of the lever 26, and thus that of the toothed bar 29, increases significantly. As the displacement travel of the toothed bar 29 becomes longer, the braking torque of the viscous brake 23, and thus the damping force acting on the closure flap 15, rises.

The modified embodiment of a glove compartment 10 which is illustrated in cross-section in Fig. 3 is changed in comparison with the design described in Figs. 1 and 2 insofar as, when the glove compartment 10 is closed and the manual movement of the closure flap 15 out of its open position illustrated in Fig. 3 into its closed position according to Fig. 1 takes place, as is necessary to bring this about, a free-wheeling or decoupling device 33 becomes active and eliminates the drive connection between the toothed bar 29 and toothed pinion 24. In the exemplary embodiment in Fig. 3, the free-wheeling or decoupling device 33 is implemented by means of a second guide track 34 which runs parallel to the first guide track 30 at a distance and is formed, together with the latter, on a link element 38 arranged on the lever 26. A guide pin 39, which protrudes from the side wall of the glove compartment 10 and forms the guide element 25, engages in the link element 38. If the guide pin 39 bears against the guide track 34, it keeps the toothing of the toothed bar 29 in engagement with the toothed pinion 24. If, on the other hand, the guide pin 39 bears against the other guide track 34, which is parallel thereto, it lifts the toothing 291 out of the toothed pinion 24 by pivoting the lever 26. The two guide tracks 30, 34 are connected to one another at their two ends by means of one diverter 35, 36 in each case, in such

a way that the guide pin 39 at the end of the respective guide track 30 or 34 runs automatically onto the respective other guide track 34 or 30. Arranged near to the diverter 35 is the stop 31 which determines the open position of the closure flap 15 and against which the guide pin 39 comes to rest after passing through the diverter 35.

The further embodiment of the glove compartment 10 (illustrated in cross-section in Fig. 5) with closure flap 15 differs from the previously described embodiments in that the arrangement of the toothed pinion 24 and toothed bar 29' of the viscous brake 23 on the lever 26 and side wall 12 of the glove compartment 10 are interchanged. While the toothed bar 29' is arranged in a stationary manner, as a circular arc section, on the side wall 12, the housing of the viscous brake 23 is seated with the toothed pinion 24 on the lever 26 which continues to be articulated at the fulcrum 27 on the closure flap 15. The toothing 291 of the toothed bar 29' is arranged on the inner arc side facing the centre of curvature of the circular arc section, while the guide track 30 for the guide element 25 is formed concentrically thereto on the outer arc side of the circular arc section facing away from the centre of curvature. The guide element 25 which is now seated on the lever 26 at a radial distance from the axis of rotation 241 of the toothed pinion 24 is designed as a sliding cam 40 which is supported on the guide track 30 and holds the toothed pinion 24 and toothing 291 in engagement with one another. In Fig. 5, the pivot travel of the closure flap 15 out of its closed position (represented by dot-dash lines in Fig. 5) into its open position (illustrated by continuous lines in Fig. 5) is divided into thirteen equal pivot angles or pivot travel sections 0 - XIII. The pivot positions which the lever 26 assumes at each pivot angle 0 - XIII of the closure flap 15 are labelled with the same numerical sequence. When the closure flap 15 in Fig. 5 moves in the clockwise direction, the lever 26 also migrates in the clockwise direction about its fulcrum 27. As can be read off from the numerical sequence 0 - 13 along the pivot travel of the lever 26, the pivot travel which is covered by the lever 26 in a pivot angle interval of the closure flap 15 increases as the opening of the glove compartment 10 increases, that is to say as the pivoting down of the closure flap 15 proceeds. As already described above, the braking torque of the viscous brake 23 thus increases continuously and reaches its maximum directly before the maximum open position of the closure flap 15 is reached, with the result that the sliding cam 40 strikes relatively gently against the stop 31, which is now

arranged at the end of the circular arc-shaped toothed bar 29'. For the rest, the embodiment in Fig. 5 corresponds to the other embodiments so that identical components are provided with identical reference symbols.

In all the embodiments described, it is advantageous to provide the described viscous brake 23 with toothed pinion 24, guide element 25 and lever 26 on both sides of the closure flap 15 in an assignment to, in each case, one side wall 12 of the glove compartment 10. As a result, it is possible, even in the case of extremely wide glove compartments 10, to ensure structurally that the movement kinematics of the closure flap 15 are reliable and robust.

The invention is not restricted to the embodiments, described above, of a closure flap for a glove compartment in the dashboard of the interior of a vehicle. The invention can, in fact, be used in all components which can be pivoted between two end positions. Examples of such components are lids of storage compartments or receptacles or accessories for equipping the interior with convenient features such as drinking vessel holders or ashtrays, which are inserted into a concealed opening when not in use and are pivoted out of this opening manually or by motor in order to be used.

Of course, it is possible to associate the viscous brake with the pivoting movement of the component in ways other than with a toothed pinion and toothed bar. It is possible, for example, to replace the toothed pinion with a friction wheel, and the toothed bar with a friction bar by means of a friction belt. Sprocket rollers and perforated strips are also suitable for the kinematic connection.

Claims

1. A damping device for a component pivotable between two end positions and having a viscous brake for decelerating the pivoting movement, which brake has a braking wheel and a driving element which engages tangentially thereon, said braking wheel and driving element moving relative to one another as the component pivots, thus causing the braking wheel to rotate, wherein, of the braking wheel and the driving element, one is arranged in a stationary manner and the other is arranged on a lever which is articulated to the component, and the articulation point of the lever on the component is situated in such a way that the displacement travel which is covered by the lever in each case within a constant pivot angle of the component increases as the pivot travel of the component proceeds from its first end position to the second end position.

2. A damping device according to Claim 1, wherein the driving element is assigned a guide track which extends parallel to it, and the braking wheel is assigned a guide element which is arranged at a radial distance from its axis of rotation and which is supported on the guide track, and the guide element and guide track are arranged in such a way that the braking wheel and driving element are held in mutual engagement.

3. A damping device according to Claim 2, wherein arranged at the end of the guide track is a stop against which the guide element strikes when the second end position of the component is reached.

4. A damping device according to any one of Claims 1 - 3, including a free-wheeling or decoupling device which is active during the pivoting-back travel of the component out of its second end position into the first end position and which eliminates the drive connection between the braking wheel and driving element.

5. A damping device according to Claim 4, wherein the free-wheeling or

decoupling device is formed by a second guide track which runs along the first guide track at such a parallel distance that when the guide element rests on the second guide track the braking wheel and driving element are disengaged, and the first and second guide tracks are connected to one another at their two ends by means of a diverter in each case, in such a way that the guide element inevitably changes over to the respective other guide track.

6. A damping device according to Claim 5, wherein at the same time the stop which defines the second end position of the component is formed on the one diverter.

7. A damping device according to any one of Claims 1 - 6, wherein the braking wheel comprises a toothed pinion, and the driving element comprises a toothed rack which inter-meshes with the toothed pinion.

8. A damping device according to Claim 7, wherein the toothed rack is arranged on the lever and extends linearly in the longitudinal direction of the lever), and the guide track is formed on a guide rack, extending along the lever parallel to the toothed rack, on its side facing the toothing.

9. A damping device according to Claim 8, wherein the toothed rack and guide rack form the bracket arms of a continuous bracket which is formed on the lever, said bracket arms surrounding the toothed pinion and the guide element.

10. A damping device according to Claim 8 or 9, wherein the guide element comprises an arc segment which is formed on the fixedly arranged housing of the viscous brake.

11. A damping device according to Claim 7, wherein the toothed rack is arranged in a stationary manner as a circular arc section with toothing formed on the arc side facing the centre of curvature, the guide track is formed concentrically with respect to the toothing on the arc side, facing away from the centre of curvature, of the

toothed rack, and the guide element is a sliding cam which is arranged at the free end of the lever.

12. A damping device for a component pivotable between two end positions substantially as described herein with reference to and as illustrated in the accompanying drawings.

The Patent Office

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Application No:	GB 9815191.3	**Examiner:**	Colin Thompson
Claims searched:	1 to 12	**Date of search:**	30 September 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): F2S (SBD,SBP); E2M

Int Cl (Ed.6): B60R 7/04,7/06; F16F 7/06,9/00,9/12,9/50,9/516

Other: Online: WPI, EDOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X,P	EP 0846886 A2	(ITW-ATECO GmbH) See Fig 1	1,2,7,8
X	EO 0771971 A1	(Illinois Tool Works Inc) See Figs 1 & 2	1,4,7

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.