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United States Patent	12384285
Kind Code	B2
Date of Patent	August 12, 2025
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Vehicle seat having a footrest

Abstract

A vehicle seat has a footrest, a seat lower part having a seat surface, which seat lower part can be or is coupled to a vehicle structure preferably in a longitudinally displaceable manner, and a seat backrest having a backrest surface. The footrest, provided with a support surface, is movable between a stowing position and a use position and is arranged, in the use position, in front of the seat lower part.

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Appl. No.: **18/284122**

Filed (or PCT Filed): **June 10, 2022**

PCT No.: **PCT/EP2022/065781**

PCT Pub. No.: **WO2022/268523**

PCT Pub. Date: December 29, 2022

Prior Publication Data

Document Identifier	Publication Date
US 20240157865 A1	May. 16, 2024

Foreign Application Priority Data

DE	10 2021 116 347.1	Jun. 24, 2021

Publication Classification

Int. Cl.: **B60N3/06** (20060101); **B60N2/90** (20180101)

U.S. Cl.:

CPC **B60N3/063** (20130101); **B60N2/929** (20180201);

Field of Classification Search

CPC: B60N (3/063); B60N (2/929)

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Background/Summary

BACKGROUND AND SUMMARY

(1) The invention relates to a vehicle seat having a footrest. It further relates to a vehicle, in particular a motor vehicle, having at least one such vehicle seat.

(2) The increasing demand for comfort in vehicles, in particular in motor vehicles, gives rise to the wish for comfort-enhancing (reclining) seats having footrests. In particular, in self-driving motor vehicles of the future, the vehicle passengers will be able to use the journey time in the vehicle in order to relax and unwind and will expect such comfort-enhancing seats to be present. When resting the legs, maximum comfort is achieved if the feet can be supported. However, if the support is provided only in the calf region, signs of fatigue can quickly occur. In most cases, the adjustment paths of a support arranged directly on the lower seat part are not sufficient to achieve the position required for resting the feet, or the actuating kinematics have to be of very solid design, which would lead to considerable additional costs and extra weight.

(3) DE 10 2010 012 767 A1 discloses a vehicle seat having a footrest which has a support panel for the feet of a passenger sitting on the vehicle seat, the support panel being arranged in front of the vehicle seat and being movable in relation to the vehicle floor. The support panel is able to be inclined upward, by way of the end remote from the seat, about a transverse axis located at the seat end of the panel. A slide is guided for sliding displacement on the longitudinal sides of the support panel and is connected to the vehicle seat via a flexible supporting element for the passenger's lower legs.

(4) DE 10 2005 013 170 A1 discloses a footrest for a vehicle, the footrest having supporting panels for the lower legs of a passenger sitting on a vehicle seat and being arranged in front of the vehicle seat and being pivotable from a vertical storage position beneath the front edge of the vehicle seat into a horizontal supporting position, in which the support panels can be extended telescopically.

(5) DE 10 2004 050 730 A1 discloses and describes a vehicle seat arrangement, which has vehicle seats arranged one behind the other, in an aircraft, wherein a flexible supporting part, which is arranged beneath a seat in front and can be pulled out in the rearward direction in the manner of a roller-blind arrangement, can be fitted on the base of a seat located behind and, in the fitted state, forms a rest for the feet and lower legs of a passenger sitting on the seat behind.

(6) FR 2 906 770 A1 discloses and describes a vehicle seat having a footrest which is able to be moved telescopically forward from a stowed position under the vehicle seat by means of a rail arrangement arranged under the seat and is able to be tilted about a transverse axis.

(7) The object of the present invention is to provide an improved vehicle seat having a footrest that can be stowed under the vehicle seat to save space when not in use.

(8) This object is achieved with the features of the independent claims.

(9) In a vehicle seat that achieves this object, having a footrest, a lower seat part with a seat surface, which lower seat part is or is able to be coupled to a vehicle structure preferably in a longitudinally displaceable manner, and a backrest with a backrest surface, wherein the footrest, provided with a supporting surface, is movable between a stowed position and a position of use and is arranged, in the position of use, in front of the lower seat part, provision is made according to the invention that the footrest has a first edge, facing away from the lower seat part, a second edge, facing toward the lower seat part, and also at least one longitudinal member extending from the first edge to the second edge, that the at least one longitudinal member is connected, in the region of the first edge,

to a first guide element of an actuating mechanism, which guide element is guided longitudinally displaceably in a guide rail of the actuating mechanism arranged in front of the lower seat part and extending away from the lower seat part, that the at least one longitudinal member is connected, in the region of the second edge, to an actuating lever belonging to the actuating mechanism, so as to be pivotable about a first transverse axis, and that the actuating lever is mounted pivotably about a second transverse axis relative to the vehicle structure or relative to the lower seat part and can be actuated pivotably about the second transverse axis by means of an actuator device.

(10) In the retracted state, the footrest according to the invention is arranged under or in front of the front region of the vehicle seat, in particular of the lower seat part. By way of the guide rail, the supporting surface of the footrest can be moved far from the vehicle seat in the longitudinal direction of the vehicle, for example forward, into the position of use.

(11) Further preferred and advantageous design features of the vehicle seat according to the invention are the subject matter of the dependent claims.

(12) It is advantageous if the first guide element, arranged longitudinally displaceably in the guide rail, is movable along the guide rail by means of the actuator device, which can be driven by a drive element. The longitudinal adjustment of the supporting surface can thus take place non-manually by means of the actuator device.

(13) Preferably, the drive element is formed by an electric motor and the actuator device by a spindle gear. This spindle gear preferably has a spindle drive with a spindle driven in rotation by the electric motor.

(14) It is also advantageous if the guide rail, at its end near the seat, is mounted so as to be pivotable about a third transverse axis relative to the vehicle structure or relative to the lower seat part. It is thereby possible to incline the supporting surface.

(15) For this, an embodiment is particularly advantageous in which the pivotably mounted guide rail forms an upper guide rail, where a lower guide rail is arranged in front of the lower seat part below the upper guide rail and extends in a longitudinal direction away from the lower seat part, and where a guide lever is provided which, in the region of its first end, is coupled pivotably relative to the longitudinal member and which, in the region of its second end, is provided with a second guide element, which is guided longitudinally displaceably in the lower guide rail. The lever kinematics formed in this way permit an automatic inclination of the supporting surface when the footrest is extended into its position of use.

(16) It is particularly advantageous if the lower guide rail is shorter than the upper guide rail, with that end of the lower guide rail near the seat being farther away from the lower seat part than that end of the upper guide rail near the seat. This geometry of the guide rails ensures that the guide lever is pivoted about a transverse axis upon extension of the footrest and thereby in turn pivots the upper guide rail and in so doing lifts the front end of the supporting surface facing away from the lower seat part.

(17) If the actuating lever is designed as a telescopic rod, which is adjustable in its longitudinal extent, further adjustment options for the position and the inclination of the supporting surface can be achieved in an advantageous manner in addition to the adjustability with the lever mechanism.

(18) An embodiment which can be combined with other embodiments of the invention, and in which the footrest is provided on each of its two longitudinal sides with a longitudinal member and an actuating mechanism assigned to the latter, is advantageous.

(19) The invention is also directed to a vehicle, in particular to a motor vehicle, having at least one vehicle seat according to the invention.

(20) Preferred exemplary embodiments of the invention with additional design details and further advantages are described and explained in more detail below with reference to the attached drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) FIG. **1**A is a side view of a schematically illustrated vehicle seat with a footrest according to an embodiment of the invention in a stowed position;

(2) FIG. **1**B is the vehicle seat from FIG. **1**A with the footrest fully extended in its position of use; and

(3) FIG. **2** is a plan view of the schematically illustrated vehicle seat from FIG. **1**B with the footrest fully extended.

DETAILED DESCRIPTION OF THE DRAWINGS

(4) FIG. **1**A and FIG. **1**B show schematic representations of a vehicle seat **1** from the left side, with a lower seat part **10** having a seat surface **11**, and with a backrest **12** which is usually attached thereto in a tiltable manner and which has a backrest surface **13**. A passenger P sitting on the vehicle seat **1** is also shown schematically. The vehicle seat is mounted, preferably longitudinally displaceably, on the passenger-compartment floor **20** of the vehicle structure **22** of a vehicle **2** via a seat console **14**, the latter being known per se and being indicated only schematically by broken lines in the figure. The vehicle seat **1** can be an individual seat or it can be part of a bench seat.

(5) The vehicle seat **1** is assigned a footrest **3** which, in the manner described below, is arranged on the lower seat part **10**, on the seat console **14** or, preferably, on the passenger-compartment floor **20** of the vehicle **2**. The footrest **3** has a support panel **30** with an upper supporting surface **31** and two lateral longitudinal members **32**, **32**′, which are connected to the support panel **30** on its two longitudinal sides facing away from each other and which extend from a first edge **33**, facing away from the lower seat part **10**, to a second edge **34**, facing toward the lower seat part **10**.

(6) As is described in detail below, the footrest **3** is movable between a stowed position beneath the lower seat part **10** and the position of use illustrated in FIG. **1**B, in which the support panel **30** of the footrest **3** is arranged in front of the lower seat part **10**.

(7) A left-side actuating mechanism **4** shown in FIG. **1** is described below, by means of which the support panel **30** of the footrest **3** can be extended from the stowed position into the position of use and retracted back into the stowed position. As can be seen in FIG. **2**, there is also a right-side actuating mechanism **4**′, which is constructed in the same way as the left-side actuating mechanism **4**, and therefore the relevant statements below also apply analogously to the right-side actuating mechanism **4**′, for which reason only the left-side actuating mechanism is described here. The two actuating mechanisms **4**, **4**′ work synchronously and are preferably driven by a common drive device **5**.

(8) The longitudinal member **32** is connected, in the region of the first edge **33**, to a first guide element **35** which is guided in a longitudinally displaceable manner in an upper guide rail **40** of the actuating mechanism **4** which is arranged in front of the lower seat part **10** and which extends away from the lower seat part **10**. The longitudinal member **32** is connected, in the region of the second edge **34**, to an actuating lever **42** belonging to the actuating mechanism **4**, so as to be pivotable about a first transverse axis y**1**. The actuating lever **42** is mounted pivotably about a second transverse axis y**2** relative to the vehicle structure **22** or relative to the lower seat part **10** and, in the manner described below, can be actuated pivotably about the second transverse axis y**2** by means of an actuator device **44** that can be driven by a drive element **45**. For this purpose, in the example shown, a bearing block **41** connected to the vehicle structure **22** is provided on which a first bearing **43**, fixed to the vehicle and defining the second transverse axis y**2**, is formed for the pivotable mounting of the actuating lever **42**. The actuating lever **42** is preferably designed as a telescopic rod which is adjustable in its longitudinal extent. In this way, the distance between the two transverse axes y**1** and y**2** forming pivot axes can be increased or decreased, as a result of which additional adjustment options for the position and the inclination of the support panel **30** and thus

of the supporting surface **31** are created. The drive element **45** for the actuator device **44** is also mounted in or on the bearing block **41**. Also provided on the bearing block **41** is a second bearing **46** fixed to the vehicle, which defines a third transverse axis y**3** and in which that end **40**A of the upper guide rail **40** near the seat is mounted pivotably relative to the vehicle structure **22**.

(9) The actuator device **44** has a spindle shaft **47**, which runs in or next to the guide rail **40** and parallel thereto and can be driven in rotation by the drive element **45**, and a spindle nut **48**, which is in threaded engagement with the spindle shaft **47**. In the example shown, the spindle nut **48** is connected to the first guide element **35** or formed integrally in the latter. The spindle shaft **47** and the spindle nut **48** therefore form a spindle gear. The first guide element **35**, arranged longitudinally displaceably in the guide rail **40** in this way, is driven by the drive element **45** movably along the upper guide rail **40**. In this case, the drive element **45** is preferably formed by an electric motor.

(10) A lower guide rail **50** is arranged below the upper guide rail **40**, in front of the lower seat part **10**, and extends away from the lower seat part **10** in the longitudinal direction X and parallel to the upper guide rail **40**. A guide lever **52** is connected, in the region of its first end, to the first guide element **35** so as to be pivotable about a fourth transverse axis y**4** and is thus coupled pivotably relative to the longitudinal member **32**. In the region of its second end, the guide lever **52** is provided with a second guide element **54** which is guided in the lower guide rail **50** in a longitudinally displaceable manner. The lower guide rail **50** is shorter than the upper guide rail **40**. That end **50**A of the lower guide rail **50** near the seat is farther away from the lower seat part **10** than that end **40**A of the upper guide rail **40** near the seat.

(11) When the first guide element **35** is moved forward out of the stowed position, i.e. away from the lower seat part **10**, by means of the spindle shaft **47**, it takes the first (front) edge **33** of the support panel **30** with it, with the support panel **30** being pivoted clockwise about the fourth transverse axis y**4**. At the same time, there is a relative pivoting between the support panel **30** and the actuating lever **42** about the first transverse axis y**1**, as a result of which the actuating lever **42** is pivoted counterclockwise about the second transverse axis y**2**, as the guide element **35** is moved forward, until the end portion **42**′ of the actuating lever **42** facing away from the transverse axis y**1** bears on an inner lower abutment surface **41**′ of the bearing block **41**. Since the lower guide rail **50** is shorter than the upper guide rail **40** in the manner described above, the guide lever **52**, in the stowed position shown in FIG. **1**A, is inclined in a downward direction away from the lower seat part **10**. This inclination has the effect that the second guide element **54** guided in the lower guide rail reaches the end stop **51** at the front end **50**B of the lower guide rail **50** remote from the seat before the first guide element **35** reaches the end stop **49** at the front end **40**B of the upper guide rail **40** remote from the seat. If the first guide element **35** is moved farther away from the lower seat part **10** by means of the spindle shaft **47**, the guide lever **52** pivots counterclockwise about a fifth transverse axis y**5** formed by the second guide element **54** and in the process lifts the front end **40**B of the upper guide rail **40**. The upper guide rail pivots clockwise about the third transverse axis y**3** and at the same time raises the front edge **33** of the support panel **30** facing away from the seat. If, in this position of use, the telescopic actuating lever **42** is extended, i.e. the distance between the transverse axes y**1** and y**2** is lengthened, as is symbolically represented in FIG. **1**B by the arrow T and the dashed line, the support panel **30** pivots counterclockwise about the transverse axis y**4** and the angle of inclination of the support panel **30** and thus also of the upper supporting surface **31** of the footrest **3** changes. When the footrest **3** is moved back from the position of use (FIG. **1**B) to the stowed position (FIG. **1**A), the movements described above take place in the opposite direction.

(12) The invention is not limited to the above exemplary embodiment, which merely serves to generally explain the core concept of the invention. Rather, within the scope of protection, the device according to the invention can also assume configurations other than those that have been described above. In this case, the device can in particular have features which represent a combination of the respective individual features of the claims.

(13) Reference signs in the claims, the description and the drawings serve only to provide a better

understanding of the invention and are not intended to limit the scope of protection.

LIST OF REFERENCE SIGNS

(14) **1** vehicle seat **2** vehicle **3** footrest **4** left-side actuating mechanism **4′** right-side actuating mechanism **5** drive device **10** lower seat part **11** seat surface **12** backrest **13** backrest surface **14** seat console **20** passenger-compartment floor **22** vehicle structure **30** support panel **31** upper supporting surface **32** longitudinal member **32′** longitudinal member **33** far edge **34** near edge **35** first guide element **40** upper guide rail **40**A end of **40** near seat **40**B end of **40** remote from seat **41** bearing block **41′** inner lower abutment face of **41** **42** actuating lever **42′** lower end portion of **42** **43** first bearing **44** actuator device **45** drive element **46** second bearing fixed to vehicle **47** spindle shaft **48** spindle nut **49** front end stop of **40** remote from seat **50** lower guide rail **50**A end of **50** near seat **50**B end of **50** remote from seat **51** front end stop of **50** remote from seat **52** guide lever **54** second guide element P passenger y**1** first transverse axis y**2** second transverse axis y**3** third transverse axis y**4** fourth transverse axis y**5** fifth transverse axis

Claims

1. A vehicle seat, comprising: a footrest; a lower seat part with a seat surface, which lower seat part is or is able to be coupled to a vehicle structure; and a backrest with a backrest surface, wherein the footrest, provided with a supporting surface, is movable between a stowed position and a position of use and is arranged, in the position of use, in front of the lower seat part, the footrest has a first edge facing away from the lower seat part, a second edge facing toward the lower seat part, and at least one longitudinal member extending from the first edge to the second edge, the at least one longitudinal member is connected, in the region of the first edge, to a first guide element of an actuating mechanism, which first guide element is guided longitudinally displaceably in a guide rail of the actuating mechanism arranged in front of the lower seat part and extending away from the lower seat part, the at least one longitudinal member is connected, in the region of the second edge, to an actuating lever belonging to the actuating mechanism, so as to be pivotable about a first transverse axis, and the actuating lever is mounted pivotably about a second transverse axis relative to the vehicle structure or relative to the lower seat part and is actuatable pivotably about the second transverse axis via an actuator.

2. The vehicle seat according to claim 1, wherein the first guide element, arranged longitudinally displaceably in the guide rail, is movable along the guide rail via the actuator, which is driven by a drive element.

3. The vehicle seat according to claim 2, wherein the drive element is formed by an electric motor and the actuator by a spindle gear.

4. The vehicle seat according to claim 1, wherein the guide rail, at its end near the lower seat part, is mounted so as to be pivotable about a third transverse axis relative to the vehicle structure or relative to the lower seat part.

5. The vehicle seat according to claim 4, wherein the pivotably mounted guide rail forms an upper guide rail, a lower guide rail is arranged in front of the lower seat part below the upper guide rail and extends in a longitudinal direction away from the lower seat part, and a guide lever is provided which, in the region of its first end, is coupled pivotably relative to the longitudinal member and which, in the region of its second end, is provided with a second guide element, which is guided longitudinally displaceably in the lower guide rail.

6. The vehicle seat according to claim 5, wherein the lower guide rail is shorter than the upper guide rail, with that end of the lower guide rail near the lower seat part being farther away from the lower seat part than that end of the upper guide rail near the lower seat part.

7. The vehicle seat according to claim 1, wherein the actuating lever is a telescopic rod which is adjustable in a longitudinal extent.

8. The vehicle seat according to claim 1, wherein the footrest is provided, on each of its two

longitudinal sides, with a respective longitudinal member and with a respectively assigned actuating mechanism.

9. A vehicle comprising at least one vehicle seat according to claim 1.