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Inventor(s)

MEGURO; Tsukasa et al.

ADJUSTING DEVICE OF FRONT AND REAR POSITIONS OF SEAT

Abstract

In an arrangement which includes: a seat support body slidably supported on a fixed rail fixed to a floor; a power supply device supplying power to an electrical component on a seat side; and a drive device driving the seat support body in a front-and-rear direction and having a motor and a transmission member disposed so as to pass longitudinally through an interior of the fixed rail, the power supply device includes: a housing an electric wire for power supply; and a slider linked to the seat support body and slidable within the fixed rail. The electric wire is drawn out from the housing, retained by the slider and slidable within the fixed rail. The slider has an interference-avoiding portion for avoiding interference with the transmission member disposed so as to pass longitudinally through the interior of the fixed rail. Accordingly, the transmission member of the drive device and the slider for retaining the electric wire, which slides within the fixed rail, can be arranged in proximity to each other within the fixed rail while avoiding interference therebetween, thus enabling simplification and a reduction in the size of a rail structure.

Inventors: MEGURO; Tsukasa (Shioya-gun, JP), SHIMADA; Toshiaki (Shioya-gun, JP), TEZUKA; Nobuyuki (Shioya-gun, JP)

Applicant: TS TECH CO., LTD. (Asaka-shi, JP)

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] This application is a continuation of U.S. patent application Ser. No. 18/615,498, filed on Mar. 25, 2024, which is a continuation of U.S. patent application Ser. No. 18/316,401, filed on May 12, 2023 (now U.S. Pat. No. 11,964,593, issued on Apr. 3, 2024), which is a continuation of U.S. patent application Ser. No. 17/703,384, filed on Mar. 24, 2022 (now U.S. Pat. No. 11,691,540, issued on Jul. 4, 2023), which is a continuation of U.S. patent application Ser. No. 17/289,645, filed on Apr. 28, 2021 (now U.S. Pat. No. 11,518,276, issued on Dec. 6, 2022), which is the U.S. National Stage entry of International Application Number PCT/JP2019/041494, filed on Oct. 23, 2019, which claims priority to U.S. Provisional Patent No. 62/751,860, filed on Oct. 29, 2018, and U.S. Provisional Patent No. 62/751,874, filed on Oct. 29, 2018, all of which are incorporated herein by reference in their entireties for all purposes.

TECHNICAL FIELD

[0002] The present invention relates to an adjusting device of front and rear positions of a seat, particularly, an adjusting device of front and rear positions of a seat, the device comprising a fixed rail that is fixed to a floor and extends in a front-and-rear direction, a seat support body that is fixed to the seat and supported on the fixed rail so that the seat support body can slide in the front-and-rear direction, and a drive device that can drive the seat support body in the front-and-rear direction with respect to the fixed rail. It is noted that in the present Description, front/rear and left/right are with reference to the front/rear and left/right of a seat in a state in which it is set in a vehicle.

BACKGROUND ART

[0003] With regard to the adjusting device of front and rear positions of a seat, there is conventionally known, as shown in for example Patent Document 1, one in which a drive device for driving a seat support body in the front-and-rear direction has a motor provided on the seat side and a transmission member that is disposed so as to pass longitudinally through the interior of a fixed rail and is involved in the transmission of a driving force from the motor to the seat support body (more specifically, a fixed threaded shaft supported on the seat support body and screwed into a nut rotating in operative connection with the motor).

RELATED ART DOCUMENTS

Patent Documents

[0004] Patent Document 1: Japanese Patent Application Laid-open No. H11-28954 [0005] Patent

Document 2: Japanese Patent Application Laid-open No. H05-330367

SUMMARY OF THE INVENTION

Problems to be Solved by the Invention

[First Problem]

[0006] In the seat of Patent Document 1, a power supply device supplying power to an electrical component on the seat side includes a power supply rail having a duct shape that is long in the front-and-rear direction and housing a power supply electric wire, and a slider slidably supported on the power supply rail and supporting a movable end part of the electric wire within the power supply rail, the slider being linked to the seat support body and being capable of moving in the front-and-rear direction together with the seat support body.

[0007] However, in this seat structure, in order for the slider to be slidably supported it is necessary to dispose and fix the power supply rail, which is formed into a duct shape that is long in the front-and-rear direction, side by side with and on the outside of the fixed rail. Because of this, there is a first problem that the overall rail structure is large and complicated and the degree of freedom in design of the structure for mounting the fixed rail on the floor is degraded due to the power supply rail.

[0008] The present invention has been proposed in light of the above circumstances, and it is a first object thereof to provide an adjusting device of front and rear positions of a seat that can solve the above first problem.

[Second Problem]

[0009] As shown in, for example, Patent Document 2, there is conventionally known an adjusting device of front and rear positions of a seat, particularly, one which includes a fixed rail fixed to a floor and extending in a front-and-rear direction, a movable rail fixed to the seat and supported on the fixed rail so as to be slidable in the front-and-rear direction, and a drive device capable of driving the movable rail in the front-and-rear direction with respect to the fixed rail, the drive device including a threaded shaft disposed so as to pass longitudinally through an interior of either one of the fixed rail and the movable rail, a nut member supported on the other one thereof and screwed around the threaded shaft, and a motor for carrying out relative rotation between the threaded shaft and the nut member.

[0010] However, in the seat of Patent Document 2, a stopper provided on the threaded shaft is made to abut against the nut member as a rigid body so as to define the forward limit or rearward limit of the movable rail (and therefore the seat) with respect to the fixed rail. Since the above stopper, however, has a flange shape that is flat in the front-and-rear direction, it is necessary for the stopper to be formed thick in the axial direction in order to enhance the support rigidity, and therefore, there is a second problem that it is disadvantageous for reducing the weight of the stopper. It is noted that in the configuration of Patent Document 2, the bearing member that supports the threaded shaft extending therethrough is disposed at an interval in the axial direction from the stopper, the bearing member having no function as a stopper.

[0011] It is a second object of the present invention to provide an adjusting device of front and rear positions of a seat that can solve the above second problem.

Means for Solving the Problems

[Means for Solving the First Problem]

[0012] In order to attain the above first object, according to a first aspect of the present invention, there is provided an adjusting device of front and rear positions of a seat, the device comprising a fixed rail that is fixed to a floor and extends in a front-and-rear direction, a seat support body that is fixed to the seat and supported on the fixed rail so that the seat support body can slide in the front-and-rear direction, a drive device that can drive the seat support body in the front-and-rear direction with respect to the fixed rail, and a power supply device that supplies power to an electrical component attached to the seat, characterized in that the drive device has a motor and a transmission member that is disposed so as to pass longitudinally through an interior of the fixed rail and is involved in transmission of driving force from the motor to the seat support body, the

power supply device includes a housing that houses an electric wire for power supply, and a slider that is linked to the seat support body and can slide within the fixed rail, the electric wire being drawn out from the housing and retained by the slider so that the electric wire can slide within the fixed rail, and the slider has an interference-avoiding portion that avoids interference with the transmission member within the fixed rail.

[0013] Furthermore, according to a second aspect of the present invention, in addition to the first aspect, the slider has a pair of electric wire-retaining parts that are arranged across a gap in a left-and-right direction within the fixed rail and a linking part that provides a link between the electric wire-retaining parts, and the interference-avoiding portion is provided in a part, opposing the transmission member, of the linking part.

[0014] Moreover, according to a third aspect of the present invention, in addition to the second aspect, the slider is disposed so that at least part of each of the electric wire-retaining parts overlaps the transmission member when the seat is viewed from a side.

[0015] Furthermore, according to a fourth aspect of the present invention, in addition to the second or third aspect, the linking part has a top wall portion that covers an upper side of the transmission member and left and right side wall portions that extend vertically downward from left and right ends of the top wall portion, and the interference-avoiding portion, which has a squared U-shaped cross section, is formed from an inner face of the top wall portion and the left and right side wall portions.

[0016] Moreover, according to a fifth aspect of the present invention, in addition to the second or third aspect, the linking part has a top wall portion that covers an upper side of the transmission member and left and right side wall portions that extend obliquely downward from left and right ends of the top wall portion so as to widen in going toward tips of the side wall portions, respectively, and the interference-avoiding portion, which has a peak-shaped cross section, is formed from an inner face of each of the top wall portion and the left and right side wall portions.

[0017] Furthermore, according to a sixth aspect of the present invention, in addition to any one of the second to fifth aspects, a first recess portion, which is formed in the linking part so that an inner face thereof is recessed upward, forms the interference-avoiding portion, a bottom wall part of the fixed rail has a second recess portion that is formed by recessing a lower part of the bottom wall part at a position opposing the interference-avoiding portion, and the transmission member extends through a space sandwiched between the first and second recess portions.

[0018] Moreover, according to a seventh aspect of the present invention, in addition to any one of the first to sixth aspects, a threaded shaft forming the transmission member is rotatably supported on the fixed rail in a state in which movement in an axial direction is restricted, a nut member screwed around the threaded shaft being fixed to the seat support body, the motor and a transmission case of a transmission mechanism that transmits an output of the motor to the threaded shaft are mounted on one end part in a front-and-rear direction of the fixed rail, and the power supply device is disposed closer to another end part in the front-and-rear direction of the fixed rail than to the motor and the transmission case.

[0019] Furthermore, according to an eighth aspect of the present invention, in addition to the seventh aspect, the housing is disposed so as to be inclined toward a middle in a left-and-right direction of the seat with respect to the fixed rail in going toward the one end part of the fixed rail when viewed from above, and a base end part, from which the electric wire is drawn, of the housing is connected to the other end part of the fixed rail.

[0020] Moreover, according to a ninth aspect of the present invention, in addition to the seventh aspect, the housing is disposed so as to extend toward a middle in a left-and-right direction of the seat while being substantially orthogonal to the fixed rail when viewed from above, and a base end part, from which the electric wire is drawn, of the housing is connected to the other end part of the fixed rail.

[0021] Furthermore, according to a tenth aspect of the present invention, in addition to any one of

the seventh to ninth aspects, a drive unit that includes the motor and the transmission case is disengageably latched with the one end part of the fixed rail via a plate spring member.

[0022] The 'fixed rail' of the present invention refers to, among a pair of left and right fixed rails L, L in an embodiment, a fixed rail in particular on which a slider 50 is slidably provided (the left fixed rail L in the embodiment).

[Means for Solving the Second Problem]

[0023] In order to attain the above second object, according to a first aspect of the present invention, there is provided an adjusting device of front and rear positions of a seat, the device comprising a fixed rail (L) that is fixed to a floor (F) and extends in a front-and-rear direction, a movable rail (U) that is fixed to the seat (S) and supported on the fixed rail (L) so that the movable rail (U) can slide in the front-and-rear direction, and a drive device (D) that can drive the movable rail (U) in the front-and-rear direction with respect to the fixed rail (L), the drive device (D) having a threaded shaft (41) disposed so as to pass longitudinally through an interior of either one rail (L) of the fixed rail (L) and the movable rail (U), a nut member (42) supported on another rail (U) thereof and screwed around the threaded shaft (41), and a motor (M) for carrying out relative rotation between the threaded shaft (41) and the nut member (42), characterized in that a bearing member (60) for supporting the threaded shaft (41) is fixed to the one rail (L), and includes a plurality of standing walls (61, 62) and a linking wall part (63), the standing walls (61, 62) having through holes (61a, 62a), respectively, through which the threaded shaft (41) is fitted, and being arranged across a gap in the front-and-rear direction, the linking wall part (63) providing an integral connection between extremities of the standing walls (61, 62), and the linking wall part (63) is formed so that a cross-sectional shape transecting the threaded shaft (41) is an arch shape or a bent shape in which at least a middle part protrudes toward a side away from the threaded shaft (41) or a side close thereto so that the middle part becomes an apex part. In accordance with this first aspect, since the bearing member fixed to the one rail and supporting the threaded shaft includes: the plurality of standing walls arranged across a gap in the front-and-rear direction and having the through holes, respectively, through which the threaded shaft is fitted; and the linking wall part providing an integral connection between the extremities of the standing walls, the bearing member can be stably supported on the one rail with a long support span in the front-and-rear direction even without the bearing member being formed thick in the front-and-rear direction. Moreover, since the linking wall part joining the plurality of standing walls to each other is formed so that the cross-sectional shape transecting the threaded shaft is an arch shape or a bent shape in which at least the middle part protrudes toward the side away from the threaded shaft or the side close thereto so that the middle part becomes an apex part, the bending stiffness of the linking wall part itself can be enhanced effectively. As a result, the bearing member can ensure a sufficient support rigidity toward the threaded shaft while lightening the weight of the bearing member.

[0024] Further, according to a second aspect of the present invention, in addition to the first aspect, among the plurality of standing walls (61, 62), the threaded shaft (41) is fitted without play and supported in the through hole (61a) of the standing wall(s) (61), which is part of the standing walls, and the threaded shaft (41) is fitted with play in the through hole (62a) of the standing wall(s) (62), which is remaining of the standing walls. In accordance with this second aspect, even when there are a plurality of the standing walls (and consequently the through holes), the through hole (bearing hole) for supporting the threaded shaft without play may be formed only in part of the plurality of standing walls, and therefore, this eliminates the necessity for strict coaxial precision between the plurality of through holes, thus making it possible to contribute to cutting the machining cost.

[0025] Further, according to a third aspect of the present invention, in addition to the second aspect, the bearing member (60) is formed from a bent band plate material, and the threaded shaft (41) is fitted and supported in the through hole (61a) of the standing wall(s) (61), which is said part of the standing walls, via a bearing bush (65). In accordance with this third aspect, even if the standing wall having the through hole as the bearing hole has a plate shape and is thin, any decrease in the

support rigidity toward the threaded shaft can be minimized.

[0026] Further, according to a fourth aspect of the present invention, in addition to the second or third aspect, the standing wall(s) (**61**), which is said part of the standing walls, is disposed further outside in an axial direction of the threaded shaft (**41**) than the standing wall(s) (**62**), which is the remaining of the standing walls, and the standing wall(s) (**62**) as the remaining has a stopper face (**62s**), which engages directly or indirectly with the nut member (**42**) and restricts a forward limit or rearward limit of the movable rail (U). In accordance with this fourth aspect, the bearing member supporting the threaded shaft also functions as a stopper member restricting the forward limit or rearward limit of the movable rail, thus accordingly simplifying the structure. Furthermore, since the functions are divided such that, among the plurality of standing walls of the bearing member, the standing wall(s) on an outer side in the axial direction acts as a bearing wall and the standing wall(s) on an inner side in the axial direction acts as stopper means, the burden on each of the standing walls can be alleviated, thus further lightening the weight.

[0027] Further, according to a fifth aspect of the present invention, in addition to any one of the first to fourth aspects, extending walls (**61w**, **62w**) extending toward sides opposite from each other in the front-and-rear direction are respectively connected integrally with base ends of first and second standing walls (**61**, **62**), as said standing walls, arranged across a gap in the front-and-rear direction, and the bearing member (**60**) is joined to the one rail (L) via the extending walls (**61w**, **62w**). In accordance with this fifth aspect, the support span of the one rail toward the bearing member can be increased due to the extension walls being specially provided, and the support rigidity toward the bearing member can be further enhanced.

[0028] Further, according to a sixth aspect of the present invention, in addition to the fourth aspect, a plate-shaped stopper wall part (**71**) through which the threaded shaft (**41**) extends at a position spaced from the nut member (**42**) in at least one of forward and backward directions is fixedly supported on the other rail (U) in a cantilever manner, and due to the stopper wall part (**71**) detachably abutting against the stopper face (**62s**), the forward limit or the rearward limit for the movable rail (U) are restricted. In accordance with this sixth aspect, since the plate-shaped stopper wall part undergo some elastic deformation, compared with a structure in which the nut member directly engages with the stopper face, the effect in absorbing impact at the time of engagement can be enhanced.

[0029] Further, according to a seventh aspect of the present invention, in addition to the fourth aspect, a pair of front and rear bearing members (**60**) as said bearing member (**60**) are fixed to the one rail (L) across a gap in the front-and-rear direction so as to sandwich the nut member (**42**) therebetween, a pair of front and rear stopper wall parts (**71**, **72**), through which the threaded shaft (**41**) extends at positions spaced from the nut member (**42**) in one and another of forward and backward directions, are fixed to the other rail (U), and the pair of front and rear stopper wall parts (**71**, **72**) detachably abut against the stopper faces (**62s**) of the pair of front and rear bearing members (**60**), respectively, thus restricting the forward limit and the rearward limit for the movable rail (U). In accordance with this seventh aspect, since there are specially provided the pair of front and rear stopper wall parts, through which the threaded shaft extends at positions spaced from the nut member in one and the other of the forward and backward directions, a region of an intermediate part of the threaded shaft that becomes free in a center run-out direction can be decreased, so that it is effective in suppressing center run-out of the threaded shaft.

[0030] Further, according to an eighth aspect of the present invention, in addition to the seventh aspect, a support plate (**70**) is disposed between the pair of front and rear bearing members (**60**) within the other rail (U), and has the pair of front and rear stopper wall parts (**71**, **72**) and an intermediate wall part (**73**) having opposite ends connected respectively to the stopper wall parts (**71**, **72**), extending in the front-and-rear direction, and being fixed to the other rail (U), and the intermediate wall part (**73**) has an intermediate bent portion (**73m**) that clasps the nut member (**42**) fixed to the other rail (U). In accordance with this eighth aspect, since the support plate is disposed

between the pair of front and rear bearing members within the other rail, and has the pair of front and rear stopper wall parts and the intermediate wall part having the opposite ends connected respectively to the stopper wall parts, extending in the front-and-rear direction, and being fixed to the other rail, and the intermediate wall part has the intermediate bent portion that clasps the nut member fixed to the other rail, it is possible to form, easily with low cost by press forming a plate material, the single support plate having the pair of front and rear stopper wall parts and exhibiting a stopper function in both forward and backward directions. Moreover, it is possible to enhance the support strength for the nut member by utilizing the intermediate bent portion of the support plate. [0031] Further, according to a ninth aspect of the present invention, in addition to the eighth aspect, a reinforcing portion (22b) is formed on the other rail (U) at a position where at least part thereof overlaps the support plate (70) in the axial direction. In accordance with this ninth aspect, it is possible to reinforce effectively, by the reinforcing portion, a region of the other rail where the burden is increased due to the support plate being fixed.

[0032] Further, according to a tenth aspect of the present invention, in addition to any one of the first to ninth aspects, the threaded shaft (41) is rotatably supported on the bearing member (60) fixed to the fixed rail (L) in a state in which movement in the axial direction of the threaded shaft (41) is restricted, the nut member (42) is fixed to the movable rail (U), the motor (M) and a transmission mechanism (30) that transmits an output of the motor (M) to the threaded shaft (41) are mounted on one end part (Lf) in the front-and-rear direction of the fixed rail (L), and a power supply device (E) for supplying power to an electrical component provided on the seat (S) is disposed closer to another end part (Lr) in the front-and-rear direction of the fixed rail (L) than to the motor (M) and the transmission mechanism (30). In accordance with this tenth aspect, it is possible to dispose the power supply device with a high degree of freedom while avoiding interference with the motor and the transmission mechanism. Moreover, due to the motor and the transmission mechanism being attached to the fixed rail, it is possible to effectively suppress transmission of vibration from the motor and the transmission mechanism to the seat side.

[0033] In the above means for solving the second problem, the fixed rail L configures one rail, the front end part Lf and the rear end part Lr of the fixed rail L configure respectively one end part and the other end part of the fixed rail, and moreover, the movable rail U configures the other rail, the first standing wall(s) 61 configures part of standing walls, and the second standing wall(s) 62 configures the remaining thereof.

Effects of the Invention

[0034] In accordance with the first aspect, with regard to the drive device, which can drive the seat support body in the front-and-rear direction with respect to the fixed rail, having the motor and the transmission member disposed so as to pass longitudinally through the interior of the fixed rail, the power supply device supplying power to an electrical component on the seat side includes the slider linked to the seat support body and being capable of sliding within the fixed rail, the electric wire for power supply, which is capable of sliding within the fixed rail, is retained on the slider, and the slider has the interference-avoiding portion for avoiding interference with the transmission member within the fixed rail. This enables the transmission member, which passes longitudinally through the interior of the fixed rail, of the drive device and the slider for retaining the electric wire, which slides within the fixed rail, to be arranged in proximity to each other within the fixed rail while avoiding interference therebetween, thus contributing to simplification and a reduction in the size of the overall rail structure. Even when the transmission member passes longitudinally through the interior of the fixed rail, since it is not necessary to specially provide slide-supporting means (e.g. a power supply rail of Patent Document 1) for the slider outside the fixed rail, the degree of freedom in design of the structure for mounting the fixed rail on the floor is enhanced.

[0035] Furthermore, in accordance with the second aspect, since the slider has the pair of electric wire-retaining parts arranged across a gap in the left-and-right direction within the fixed rail, and the linking part providing a link between the electric wire-retaining parts, and the interference-

avoiding portion is provided on a part, opposing the transmission member, of the linking part, the interference-avoiding portion can be formed compactly without difficulty by utilizing the linking part linking the left and right electric wire-retaining parts, and it is therefore possible to suppress any increase in the lateral dimension of the fixed rail due to both the transmission member and the slider being disposed in the interior thereof.

[0036] Moreover, in accordance with the third aspect, since the slider is disposed so that at least part of each of the electric wire-retaining parts overlaps the transmission member when the seat is viewed from the side, it becomes possible to suppress any increase in the longitudinal dimension due to the fixed rail having both the slider and the transmission member disposed in the interior thereof.

[0037] Furthermore, in accordance with the fourth aspect, since the linking part has the top wall portion covering the upper side of the transmission member and the left and right side wall portions extending vertically downward from the left and right ends of the top wall portion, and the inner faces of the top wall portion and left and right side wall portions form the interference-avoiding portion having a squared U-shaped cross section, due to the left and right side wall portions of the interference-avoiding portion each being a vertical wall, it is possible to suppress any increase in the width in the left-and-right direction of the interference-avoiding portion, thus reducing the dimension in the left-and-right direction of the linking part, and consequently the slider.

[0038] Moreover, in accordance with the fifth aspect, since the linking part has the top wall portion covering the upper side of the transmission member and the left and right side wall portions extending obliquely downward from the left and right ends of the top wall portion so as to spread out in going toward the tip, and the inner faces of the top wall portion and left and right side wall portions form the interference-avoiding portion having a peak-shaped cross section, due to the slider having the lower half of the linking part spreading out in going toward the tip and downward, interference with the transmission member can be avoided without difficulty and, moreover, since the top wall portion of the linking part has a relatively small width, a portion of the slider that is exposed from the upper end of the fixed rail can be made small in the left-and-right direction, thus avoiding effectively interference with other objects.

[0039] Furthermore, in accordance with the sixth aspect, since the first recess portion, which is formed in the linking part so that the inner face thereof is recessed upward, forms the interference-avoiding portion, the bottom wall part of the fixed rail has the second recess portion, which is formed by recessing the lower part at least at the position opposing the interference-avoiding portion, and the transmission member extends through the space sandwiched between the first and second recess portions, it is possible to ensure a wide space for placing the transmission member and a component therearound due to the first and second recess portions. Moreover, since the part, corresponding to the second recess portion, of the bottom wall part of the fixed rail can exhibit a reinforcing rib effect, it is possible to contribute to an increase in the bending stiffness of the fixed rail.

[0040] Moreover, in accordance with the seventh aspect, since the threaded shaft forming the transmission member is rotatably supported on the fixed rail in a state in which movement in the axial direction is restricted, the nut member screwed around the threaded shaft is fixed to the seat support body, the motor and the transmission case of the transmission mechanism, which transmits the output of the motor to the threaded shaft, are mounted on one end part in the front-and-rear direction of the fixed rail, and the power supply device is disposed closer to the other end part in the front-and-rear direction of the fixed rail than to the motor and the transmission case, it is possible to avoid interference between the motor and transmission mechanism and the housing without difficulty, thus enhancing the degree of freedom in arrangement thereof. Moreover, it is possible to suppress effectively transmission of vibration from the motor and the transmission mechanism to the seat side, thus contributing to improvement of the ride comfort of the seat.

[0041] Furthermore, in accordance with the eighth aspect, since the housing is disposed so as to be

inclined toward the middle in the left-and-right direction of the seat with respect to the fixed rail in going toward the one end part of the fixed rail when viewed from above, and the base end part, from which the electric wire is drawn, of the housing is connected to the other end part of the fixed rail, the housing can be disposed compactly in the front-and-rear direction in a dead space between the left and right fixed rails immediately below the seat. Moreover, due to the housing being inclined with respect to the fixed rail when viewed from above, compared with a case in which the housing is provided along the fixed rail, the curvature of the electric wire that is drawn out of the housing and bent back toward the fixed rail side can be reduced, and the electric wire can therefore be smoothly bent without difficulty.

[0042] Moreover, in accordance with the ninth aspect, since the housing is disposed so as to extend toward the middle in the left-and-right direction of the seat while being substantially orthogonal to the fixed rail when viewed from above, and the base end part, from which the electric wire is drawn, of the housing is connected to the other end part of the fixed rail, there is no possibility of the housing and a portion of the fixed rail fixed to the floor being superimposed on one another in the up-and-down direction, thus further improving the degree of freedom in design. Furthermore, due to the housing being substantially orthogonal to the fixed rail when viewed from above, compared with a case in which the housing is provided along the fixed rail, the curvature of the electric wire that is drawn out of the housing and curved toward the fixed rail side can be further reduced, and the electric wire can therefore be more smoothly bent.

[0043] Furthermore, in accordance with the tenth aspect, since the drive unit, which includes the motor and the transmission case, is disengageably latched with the one end part of the fixed rail via the plate spring member, not only does the ease of mounting the drive unit, including the motor and the transmission case, on the one end part of the fixed rail improve, but it is also possible to reduce effectively the amount of vibration transmitted from the motor and the transmission mechanism to the floor and the seat due to elastic deformation of the plate spring member.

Description

BRIEF DESCRIPTION OF DRAWINGS

[0044] FIG. 1 is an overall perspective view showing one example of an adjusting device of front and rear positions of an automobile seat related to a first embodiment of the present invention.

[0045] FIG. 2 is an overall plan view showing the adjusting device of front and rear positions.

[0046] FIG. 3 is an enlarged sectional view along line 3-3 in FIG. 2.

[0047] FIG. 4 is an enlarged sectional view along line 4-4 in FIG. 2 (sectional view along line 4-4 in FIG. 2, FIG. 5, and FIG. 6).

[0048] FIG. 5 is an enlarged sectional view along line 5-5 in FIG. 4.

[0049] FIG. 6 is an enlarged sectional view along line 6-6 in FIG. 4.

[0050] FIG. 7A is a sectional view, corresponding to FIG. 5, showing a first modified example of a bearing member.

[0051] FIG. 7B is a sectional view, corresponding to FIG. 5, showing a second modified example of a bearing member.

[0052] FIG. 8 is a plan view showing an essential part of an adjusting device of front and rear positions related to a second embodiment of the present invention (view corresponding to FIG. 2)

[0053] FIG. 9 is a sectional view, corresponding to FIG. 6, showing an essential part of an adjusting device of front and rear positions related to a third embodiment of the present invention.

[0054] FIG. 10 is a sectional view, corresponding to FIG. 3, showing an essential part of an adjusting device of front and rear positions related to a fourth embodiment of the present invention.

[0055] FIG. 11 is a plan view, corresponding to FIG. 2, showing an essential part of an adjusting device of front and rear positions related to a fifth embodiment of the present invention.

[0056] FIG. 12 is an enlarged sectional view along line 12-12 in FIG. 11.

EXPLANATION OF REFERENCE NUMERALS AND SYMBOLS

[0057] A adjusting device of front and rear positions [0058] D drive device [0059] Du drive unit [0060] E power supply device [0061] F floor frame as floor [0062] H housing [0063] Ha base end part [0064] L fixed rail [0065] Lf, Lr front end part (one end part) and rear end part (another end part) of fixed rail [0066] M motor [0067] S seat for automobile as seat [0068] U movable rail as seat support body [0069] 12 bottom wall part of fixed rail [0070] 12h second recess portion [0071] 30 transmission mechanism [0072] 31 gear box as transmission case [0073] 41 threaded shaft as transmission member [0074] 42 nut member [0075] 50 slider [0076] 50c interference-avoiding portion [0077] 51 linking part [0078] 51h first recess portion [0079] 51s left and right side wall portions [0080] 51t top wall portion [0081] 52, 53 pair of electric wire-retaining parts [0082] 80 electric wire [0083] 90 plate spring member

MODES FOR CARRYING OUT THE INVENTION

[0084] Embodiments of the present invention are explained below by reference to the attached drawings. In the present invention and the present specification, front/rear, left/right, and up/down are the front/rear, left/right, and up/down as viewed by an occupant seated on a seat.

[0085] A first embodiment is now explained referring to FIG. 1 to FIG. 6. A seat S for an automobile is supported on a floor frame F, which is part of a vehicle body, via an adjusting device A of front and rear positions so that the front and rear positions can be adjusted. The floor frame F is one example of a floor.

[0086] The adjusting device A of front and rear positions includes left and right fixed rails L that are fixedly (e.g. by means of a bolt) placed on the floor frame F via a plurality of support frames 7 to 9 and extend in the front-and-rear direction so as to be parallel to each other, left and right movable rails U as a seat support body supported on the respective fixed rail L so that they can slide in the front-and-rear direction, a drive device D that can drive the movable rail U (and consequently the seat S) with respect to the fixed rail L in the front-and-rear direction, and a power supply device E that supplies power to an electrical component, which is not illustrated, mounted on the seat S. The electrical component referred to here includes for example an electric reclining mechanism that is for adjusting the angle of inclination of a seat back, a seat sensor that detects the presence/absence of an occupant sitting on the seat S, and a seat belt sensor that detects whether an occupant on the seat is wearing a seat belt.

[0087] A downward-facing hanging wall part 100 is fixedly provided on a base plate of a seat part of the seat S, and an upper part of the movable rail U is detachably joined to the hanging wall part 100 via for example a plurality of pairs of bolts and nuts 101.

[0088] Furthermore, the plurality of support frames 7 to 9 are arranged at intervals in the front-and-rear direction on the floor frame F, some thereof (for example, the support frames 7 and 9 in the front and the rear) extend lengthwise in the left-and-right direction and function as cross members that join the left and right fixed rails L, and others (for example, the support frame 8 in the middle in the front-and-rear direction) are formed so as to be short in the left-and-right direction and are individually joined to the left and right fixed rails L. As joining means therefor, in this embodiment a weld nut and a bolt are used, but another joining means (e.g. welding) is also possible. The combination of long and short shapes for the support frames 7 to 9 is optional and is not limited to that of the embodiment. Furthermore, all of the support frames 7 to 9 may be short as for the support frame 8 of the embodiment or may be long as for the support frames 7 and 9 of the embodiment.

[0089] Each of the left and right fixed rails L includes, as clearly shown in FIG. 5 in particular, a strip-shaped bottom wall part 12 extending in the front-and-rear direction, and substantially vertical left and right side wall parts 13 and 14 standing integrally with and above the left and right ends of the bottom wall part 12. The bottom wall part 12 has a recess portion 12h that is recessed downward in a middle part in the left-and-right direction, and left and right horizontal flat parts

respectively connected to opposite sides of the recess portion **12h** act as a travel guide face **12a** for a roller **24**, which is described later.

[0090] On the other hand, each of the left and right movable rails **U** is formed dividedly from left and right movable rail half bodies **22**, and the movable rail half bodies **22** are integrally joined (e.g. by riveting **23**) by abutting upper halves thereof against each other. Lower halves of the left and right movable rail half bodies **22** integrally have top wall portions **22t** that are connected to the upper halves and protrude substantially horizontally toward opposite sides from each other, and side wall portions **22s** that substantially vertically extend downward from outer ends of the top wall portions **22t**. An upward-facing flange-shaped roller support portion **22f** integrally and inversely extends upward from the lower end of each side wall portion **22s**, and a pair of front and rear rollers **24** are rotatably and pivotally supported on each of the roller support portions **22f** across a gap in the front-and-rear direction.

[0091] Flange portions **13f** and **14f** are connectedly provided integrally with the upper ends of the left and right side wall parts **13** and **14** of each fixed rail **L**, and the flange portions **13f** and **14f** are formed into an L-shaped cross section while having an inward-facing base part covering the upper side of the roller **24** and a downward-facing tip part extending substantially vertically downward from the inner end of the inward-facing base part. The downward-facing tip part of each of the flange portions **13f** and **14f** is loosely fitted into a gap between the side wall portion **22s** and the roller support portion **22f** of the movable rail **U**. The roller **24** of each movable rail **U** rolls on the travel guide face **12a** of each fixed rail, thus allowing each movable rail **U** to slide smoothly on each fixed rail **L** in the front-and-rear direction via the roller **24**.

[0092] One example of the drive device **D**, which drives the movable rail **U** (seat **S**) in the front-and-rear direction, is now explained.

[0093] The drive device **D** includes a threaded shaft **41** disposed so as to pass longitudinally through the interior of each of the left and right fixed rails **L**, front and rear bearing members **60** allowing front and rear end parts of the threaded shaft **41** to be rotatably supported on the fixed rail **L**, a nut member **42** screwed around the threaded shaft **41** between the front and rear bearing members **60** and fixed to the movable rail **U**, a motor **M** outputting rotational power for carrying out relative rotation between the threaded shaft **41** and the nut member **42**, and a transmission mechanism **30** for transmitting the output of the motor **M** to the threaded shaft **41** and rotating the threaded shaft **41**.

[0094] The nut member **42** is joined (e.g. welded) to an inner face of the lower half (more specifically, the top wall portion **22t**) of the movable rail **U**. The threaded shaft **41** and the nut member **42** are in cooperation with each other and function as a transmission member that is involved in the transmission of driving force from the motor **M** to the movable rail **U**.

[0095] A drive unit **Du** that rotates the threaded shaft **41** is mounted on a front end part **Lf** of the left and right fixed rails **L**. This drive unit **Du** includes the motor **M**, left and right gear boxes **31** each housing the transmission mechanism **30**, and a base frame **38** to which the motor **M** and the gear box **31** are joined (e.g. by means of a bolt), the base frame **38** being formed into a channel frame shape extending in the left-and-right direction. Due to the left and right gear boxes **31** being detachably joined to the front end parts **Lf** of the left and right fixed rails **L** respectively, the drive unit **Du** is mounted on the fixed rail **L**. The gear box **31** is one example of a transmission case.

[0096] The gear box **31** is dividedly formed from for example a gear box main body **311** and a lid body **312** detachably joined (e.g. press fitted) to an open end part thereof, and is formed into a box shape from a synthetic resin material. A side wall **31w**, on the fixed rail **L** side, of the gear box **31** abuts against an outer face of a cover **35** that detachably blocks an opening of the front end part **Lf** of the fixed rail **L**, and is disengageably latched and fixed to the fixed rail **L** via a plate spring member **90** in the abutment state.

[0097] That is, a base part of the plate spring member **90** is joined (e.g. by means of a bolt) to the front end part **Lf** of the fixed rail **L** together with the support frame **7**, and a latching claw **90a** is

provided at the tip part of the plate spring member **90** by cutting and raising part thereof. The gear box **31** has a slit hole **31s** that opens on an outer face of the side wall **31w** and into which the plate spring member **90** is removably inserted, and a latching hole **31h** that opens on an inner face of the slit hole **31s** and is capable of latching with the latching claw **90a**.

[0098] Therefore, if the tip part of the plate spring member **90** is pushed into the slit hole **31s**, the latching claw **90a** can be automatically latched with the latching hole **31h**, and the gear box **31**, and consequently the drive unit Du, can therefore be latched and fixed to the left and right fixed rails L quickly and simply with a single touch, thus improving the ease of mounting the gear box **31** (drive unit Du) on the fixed rail L. Moreover, due to elastic deformation of the plate spring member **90**, the amount of vibration transmitted from the motor M and the transmission mechanism **30** to the floor frame F and the seat S can be reduced effectively.

[0099] A motor shaft **37** extends out from the motor M in the left and right directions and projects into the left and right gear boxes **31**, and a worm gear **37g** is fitted and fixed to the outer periphery of an end part thus projecting. A transmission shaft **36** coaxially linked to the front end of the threaded shaft **41** via a joint J is rotatably supported on the gear box **31**, and a worm wheel gear **36g** is fitted and fixed to the outer periphery of an intermediate part of the transmission shaft **36**, the worm wheel gear **36g** meshing with the worm gear **37g** and transmitting rotation of the motor shaft **37** to the transmission shaft **36** (and consequently the threaded shaft **41**).

[0100] One example of the bearing member **60** is now explained mainly by reference to FIG. 3 to FIG. 5. The bearing member **60** has an intermediate part in the longitudinal direction formed from a bent band plate material, and includes for example first and second standing walls **61** and **62** that are arranged across a gap in the front-and-rear direction while each having through holes **61a** and **62a** through which the threaded shaft **41** is fitted, and a linking wall part **63** that integrally joins tip ends (upper ends) of the standing walls **61** and **62** to each other.

[0101] Extending walls **61w** and **62w** extending toward sides opposite from each other in the front-and-rear direction are connectedly provided integrally with base ends (lower ends) of the first and second standing walls **61** and **62** respectively, and the bearing member **60** is joined (e.g. by means of a bolt) to the bottom wall part **12** of the fixed rail L by means of the extending walls **61w** and **62w**.

[0102] With regard to the linking wall part **63**, a cross-sectional shape that transects the threaded shaft **41** is an arch shape. The cross-sectional shape of the linking wall part **63** is not limited to the illustrated example; it may be a bent shape that protrudes toward the side further away from or the side closer to the threaded shaft **41** so that at least a middle part is an apex part, and may be for example a peak shape, as shown in FIG. 7 (A), in which only the middle part protrudes toward the side further away from the threaded shaft **41** or a squared U-shape, as shown in FIG. 7 (B), in which the opening faces downward. Although not illustrated, in a manner that is opposite to that in FIG. 7, the cross-sectional shape of the linking wall part **63** may be a peak shape in which only a middle part protrudes toward the side closer to the threaded shaft **41** or may be a squared U-shape in which the opening faces upward.

[0103] The threaded shaft **41** is fitted without play and supported via a bearing bush **65** in one of the first and second standing walls **61** and **62** (in the illustrated example one on the outer side in the axial direction), that is, the through hole **61a** of the first standing wall **61**, and the threaded shaft **41** is fitted with play into the other (in the illustrated example one on the inner side in the axial direction), that is, the through hole **62a** of the second standing wall **62**. A modified example in which the bearing bush **65** is omitted and the threaded shaft **41** is rotatably fitted and supported directly in the through hole **61a** can also be implemented.

[0104] The threaded shaft **41** integrally has a large-diameter first male thread portion **41a** around which the nut member **42** is screwed, a bush support portion **41b** that is adjacent to front and rear ends of the first male thread portion **41a** via a flange portion **41f** and around which the bearing bush **65** is fitted, and a small-diameter second male thread portion **41c** that is adjacent to the outer

end of the bush support portion **41b** via a step part.

[0105] A nut **45** that closely opposes the outer end of the bearing bush **65** is screwed around each of the left and right second male thread portions **41c**, the nut **45** engaging with the first standing wall **61** of the bearing member **60** to thus restrict axial movement of the threaded shaft **41**. An extending shaft portion **41d** having a yet smaller diameter is provided so as to be connected to the second male thread portion **41c**, on the front side in particular, of the threaded shaft **41**, and the extending shaft portion **41d** is connected to the transmission shaft **36** on the gear box **31** side via the joint J.

[0106] The second standing wall **62** has a stopper face **62s** that indirectly engages with the nut member **42** (that is, via a support plate **70**, which is explained below) to thus restrict the forward limit or the rearward limit of the movable rail U.

[0107] The support plate **70** includes front and rear stopper wall parts **71** and **72** that are arranged across a gap in the front-and-rear direction while each having a through hole through which the threaded shaft **41** slightly loosely extends, and an intermediate wall part **73** that extends lengthwise in the front-and-rear direction while having opposite ends thereof integrally connected to the stopper wall parts **71** and **72**. The support plate **70** is disposed within the movable rail U between the front and rear bearing members **60**, and the intermediate wall part **73** has an intermediate bent portion **73m** that clasps the nut member **42** fixed to the movable rail U. The intermediate bent portion **73m** may be fixed (e.g. welded) to the nut member **42** or may not be fixed.

[0108] The intermediate wall part **73** is joined (e.g. welded) to an inner face of one of the left and right side wall portions **22s** of the lower half of the movable rail U. The support plate **70** is thereby fixed to the movable rail U, and the base end of each of the front and rear stopper wall parts **71** and **72** is fixed to the movable rail U (more specifically, the side wall portion **22s**) via the intermediate wall part **73**, that is, it is cantilever-supported.

[0109] The front and rear stopper wall parts **71** and **72** of the support plate **70** detachably abut against the stopper faces **62s** of the front and rear bearing members **60** respectively, thus restricting the forward limit/rearward limit of the movable rail U. In addition, the support plate **70** may be omitted, and the nut member **42** may be made to abut directly against the stopper face **62s** of each of the front and rear bearing members **60**.

[0110] A reinforcing portion **22b** is provided on the movable rail U, the upper half of each movable rail half body **22** in particular, at a position where at least part thereof overlaps the support plate **70** in the axial direction. The reinforcing portion **22b** is formed by plastically deforming part of the upper half of the movable rail half body **22** into a rib shape protruding outward in the left-and-right direction. Due to the reinforcing portion **22b** being specially provided, it becomes possible to reinforce effectively, by means of the reinforcing portion **22b**, a region of the movable rail U where the burden is increased due to the support plate **70** being fixed.

[0111] One example of the power supply device E is now explained mainly by reference to FIGS. **1**, **2**, **4**, and **6**.

[0112] The power supply device E includes an electric wire **80** for power supply, a housing H for housing the electric wire **80**, and a slider **50** that is linked to one (in the illustrated example the left side) of the left and right movable rails U and is capable of sliding within the fixed rail L on the same side. The electric wire **80** is, throughout substantially the entire length thereof, loosely inserted into a bellows-shaped protective tube **81** formed from a synthetic resin material and having flexibility, and due to the covering and protecting action of the protective tube **81** the electric wire **80** is protected from being forcibly bent.

[0113] Part of the electric wire **80**, that is, a movable end portion **80a**, which is drawn out from the housing H as described later and can slide within the fixed rail L, is embedded in and retained by the slider **50** together with a movable end part of the protective tube **81**, which surrounds the movable end portion **80a**.

[0114] In the present invention and the present specification, the 'electric wire' referred to may be a single line of lead wire or may be in a state called a wire harness that is formed by binding a

plurality of lead wires, but in the illustrated example the wire harness is simply called an electric wire.

[0115] The housing H is formed into a box shape that extends linearly in a predetermined direction and is flat in the up-and-down direction so that it can be disposed without difficulty in a confined space immediately below the seat S, and a pair of the electric wires **80** each surrounded by the bellows-shaped protective tube **81** are housed in the interior of the housing H. End parts on the vehicle body side of the pair of electric wires **80** are made to converge together, and the converged portion is connected to a coupler **82** fixedly provided at an appropriate position of an outer face of the housing H. This coupler **82** is removably joined to a coupler **84** connected to an electric wire **83** extending from an electronic control device (not illustrated) on the vehicle body side. A base end part Ha of the housing H is detachably connected to a rear end part Lr of one of the left and right fixed rails L. The base end part Ha is provided with an opening facing the inner space of the fixed rail L, and this opening functions as a lead-out port for the pair of electric wires **80** each surrounded by the protective tube **81**. Therefore, the pair of electric wires **80** housed within the housing H and each surrounded by the protective tube **81** are drawn out into the fixed rail L through the opening of the base end part Ha of the housing H and can follow sliding in the front-and-rear direction of the slider **50** and come into sliding contact with the interior of the fixed rail L (more specifically, the top of the travel guide face **12a**).

[0116] The housing H of the present embodiment in particular is disposed so as to be inclined toward the seat middle side in the left-and-right direction in going toward the front end part Lf of the fixed rail L with respect to the fixed rail L when viewed from above. In accordance with this arrangement, the housing H can be contained in a compact manner in the front-and-rear direction in a dead space between the left and right fixed rails L and L immediately below the seat S. Moreover, due to the housing H being inclined with respect to the fixed rail L when viewed from above, compared with a case in which the housing H is provided along the fixed rail L, the curvature of the electric wire **80**, which is drawn out from the opening in the base end part Ha of the housing H and turned back toward the fixed rail L side, can be made small, and the electric wire **80** can be smoothly bent without difficulty within the housing H, thus improving the durability of the electric wire **80**.

[0117] One example of the slider **50** is now explained. The slider **50** has a slider base part **50B** having a majority thereof disposed within the fixed rail L, and a slider extremity **50A** connectedly provided integrally with an upper part of the slider base part **50B** via a constriction portion **50m** and protruding further upward than the fixed rail L, and is formed from a synthetic resin material. The slider base part **50B** includes a pair of electric wire-retaining parts **52** and **53** arranged across a gap in the left-and-right direction within the fixed rail L and a linking part **51** providing an integral link between the electric wire-retaining parts **52** and **53**.

[0118] The electric wire-retaining parts **52** and **53** are placed on and supported by the travel guide face **12a** of the bottom wall part **12** of the fixed rail L so that they can slide in the front-and-rear direction. A tip end part of the bellows-shaped protective tube **81**, which is drawn into the fixed rail L through the opening of the base end part Ha of the housing H, and part of the electric wire **80** extending out from the tip end part of the protective tube **81**, that is, the movable end portion **80a**, are integrally covered and retained by the electric wire-retaining parts **52** and **53**. The movable end portion **80a** of the electric wire **80** extends upward within the slider extremity **50A** and is made to converge, and the converged portion is connected to a coupler **86** fixedly provided on the slider extremity **50A**. This coupler **86** is removably joined to a coupler **88** connected to an electric wire **87** extending from the electrical component on the seat S side.

[0119] The linking part **51** has a top wall portion **51t** that can cover the upper side of the threaded shaft **41** and the bearing member **60**, and left and right side wall portions **51s** extending vertically downward from left and right ends of the top wall portion **51t**, and inner faces of the top wall portion **51t** and the left and right side wall portions **51s** form an interference-avoiding portion **50c**

having a squared U-shaped cross section for avoiding interference with the threaded shaft **41** and the bearing member **60**. That is, a first recess portion **51h** that is formed by recessing upward an inner face of the linking part **51** (that is, a face opposing the threaded shaft **41**) is formed as the interference-avoiding portion **50c** for avoiding interference with the threaded shaft **41** and the bearing member **60**.

[0120] A wide space sandwiched by the first recess portion **51h** (interference-avoiding portion **50c**) and the second recess portion **12h** formed by recessing downward the bottom wall part **12** of the fixed rail L so as to oppose the first recess portion **51h** is ensured, the threaded shaft **41** passes longitudinally through this space, and the bearing member **60** can pass through relative thereto. That is, it becomes possible by means of the first and second recess portions **51h** and **12h** to ensure a sufficiently wide space for disposing the threaded shaft **41** and a peripheral component (e.g. the bearing member **60**) and, moreover, a portion corresponding to the second recess portion **12h** of the bottom wall part **12** of the fixed rail L is capable of exhibiting a reinforcing rib effect, thereby increasing the bending stiffness of the fixed rail L.

[0121] The slider **50** is disposed so that at least part of the electric wire-retaining parts **52** and **53** overlaps the threaded shaft **41** when the seat is viewed from the side. In accordance with this arrangement, due to the fixed rail L having both the slider **50** (in particular, the electric wire-retaining parts **52** and **53**) and the threaded shaft **41** disposed in the interior thereof, it becomes possible to suppress any increase in the vertical dimension.

[0122] The slider **50** is detachably joined to the movable rail U via linking means, which is explained below. That is, the linking means includes an elastic latching claw **51a** projectingly provided at the front end of the linking part **51** (more specifically, the side wall portion **51s**) of the slider **50** and extending forward, and a latching hole **22h** formed in the side wall portion **22s** of the lower half of the movable rail half body **22** so as to correspond to the elastic latching claw **51a**. A latching projection **51** at is provided at the tip part of the latching claw **51a**, and this latching projection **51** at is disengageably latched with the latching hole **22h**. Due to such latching, it is possible to detachably join the slider base part **50B** to the lower half of the movable rail U while maintaining a state in which the slider extremity **50A** is abutted against the rear end of the upper half of the movable rail U, thereby enabling the slider **50** to follow the movable rail U and move in the front-and-rear direction.

[0123] The linking means between the slider **50** and the movable rail U is not limited to the structure of the embodiment, and various types of linking means (e.g. joining by a bolt, joining by swaging, etc.) may be employed.

[0124] The fixed rail L is covered neatly by a floor carpet (not illustrated) that covers an upper face of the floor frame F. In this case, the floor carpet is appropriately provided with a slit that allows movement of the movable rail U and the slider **50** in the front-and-rear direction, that is, the upper half of the movable rail U, which is narrow in the left-and-right direction, and the constriction portion **50m** of the slider **50** can move in the front-and-rear direction in the gap of the slit.

[0125] The operation of the first embodiment explained above is now explained. When, for example, an occupant operates an operating switch (not illustrated) on the door inner face so as to rotate the motor M forward or backward, the rotational power rotates the threaded shaft **41** forward or backward via the motor shaft **37**, and the left or right transmission mechanism **30**, the transmission shaft **36**, and the joint J, and in operative connection therewith the nut member **42** (and therefore the movable rail U and consequently the seat S) slides forward or backward on the fixed rail L. Since this sliding is carried out via the roller **24**, which rolls on the travel guide face **12a** of the inner face of the fixed rail L, the sliding resistance can be made very small.

[0126] When the seat S attains a desired position in the front-and-rear direction, stopping operating the operating switch makes the motor M stop, thereby enabling the seat S to be adjusted to the desired position in the front-and-rear direction at any time. Control to energize the motor M may be automated by an electronic control device, thus carrying out automatic adjustment to a preset

position in the front-and-rear direction.

[0127] While following the seat S sliding in the front-and-rear direction, the slider **50** slides in the front-and-rear direction within the fixed rail L, and part of the electric wire **80**, which is drawn out from the housing H following the above, slides in the front-and-rear direction within the fixed rail L (more specifically, on the travel guide face **12a**) together with the protective tube **81**.

[0128] In the present embodiment, the drive unit Du, which includes the motor M outputting the driving force for driving the movable rail U (the seat S) in the front-and-rear direction and the gear box **31** of the transmission mechanism **30** for transmitting the output of the motor M to the threaded shaft **41**, is mounted on the front end part Lf of the fixed rail L, and the power supply device E (e.g. the housing H, the slider **50**, etc.) for supplying power to the electrical component on the seat S side is disposed closer to the rear end part Lr of the fixed rail L than the drive unit Du (e.g. the motor M, the gear box **31**, the transmission mechanism **30**). This enables interference between the drive unit Du (the motor M, the gear box **31**, the transmission mechanism **30**) and the power supply device E (the housing H, the slider **50**) to be avoided without difficulty, thus enhancing the degree of freedom in the arrangement thereof. Moreover, transmission of vibration from the motor M and the transmission mechanism **30** to the seat S side can be suppressed effectively, thus improving the ride comfort of the seat S.

[0129] Furthermore, in the present embodiment, the drive device E has the motor M and the threaded shaft **41** as a transmission member disposed so as to pass longitudinally through the interior of the fixed rail L, whereas the power supply device E supplying power to the electrical component on the seat S side includes the slider **50** linked to the movable rail U and being capable of sliding within the fixed rail L, the movable end portion **80a** of the electric wire **80** for power supply, which is capable of sliding within the fixed rail L, is retained on the slider **50**, and the slider **50** has the interference-avoiding portion **50c** for avoiding interference with the threaded shaft **41** within the fixed rail L.

[0130] This enables the bearing member **60** or the threaded shaft **41**, which passes longitudinally through the interior of the fixed rail L, of the drive device D and the slider **50** for retaining the electric wire, which slides within the fixed rail L, to be arranged in proximity to each other within the fixed rail L while avoiding interference therebetween, thus contributing to simplification and a reduction in the size of the overall rail structure. Even when the threaded shaft **41** passes longitudinally through the interior of the fixed rail L, since it is not necessary to specially provide slide-supporting means (e.g. a power supply rail of Patent Document 1) for the slider **50** outside the fixed rail L, such slide-supporting means will not be superimposed on the support frames **7** to **9** in the up-and-down direction, and the degree of freedom in design of the structure for mounting the fixed rail L on the floor frame F is enhanced.

[0131] Moreover, the slider **50** of the present embodiment has the pair of electric wire-retaining parts **52** and **53** arranged across a gap in the left-and-right direction within the fixed rail L, and the linking part **51** providing a link between the electric wire-retaining parts **52** and **53**, and the interference-avoiding portion **50c** is provided on a part, opposing the threaded shaft **41**, of the linking part **51**. Since this enables the interference-avoiding portion **50c** to be formed compactly without difficulty by utilizing the linking part **51** linking the left and right electric wire-retaining parts **52** and **53**, it is possible to suppress effectively any increase in the lateral dimension of the fixed rail L due to the threaded shaft **41**, the bearing member **60**, and the slider **50** being disposed in the interior thereof.

[0132] Furthermore, the linking part **51** has the top wall portion **51t** covering the upper side of the threaded shaft **41** and the left and right side wall portions **51s** extending vertically downward from the left and right ends of the top wall portion **51t**, and the inner faces of the top wall portion **51t** and left and right side wall portions **51s** form the interference-avoiding portion **50c** having a squared U-shaped cross section. In this case, due to the left and right side wall portions **51s** of the interference-avoiding portion **50c** each being a vertical wall, it is possible to suppress any increase in the width

in the left-and-right direction of the interference-avoiding portion **50c** as much as possible, thus advantageously reducing the dimension in the left-and-right direction of the linking part **51**, and consequently the slider **50**.

[0133] Moreover, in the present embodiment, the bearing member **60** fixed to the fixed rail L and supporting the threaded shaft **41** includes the plurality of standing walls **61** and **62** each having the through holes **61a** and **62a**, through which the threaded shaft **41** is fitted, and being arranged across a gap in the front-and-rear direction, and the linking wall part **63** providing an integral connection between the extremities of the standing walls **61** and **62**. This enables the bearing member **60** to be stably supported on the fixed rail L with a long support span in the front-and-rear direction even without it being formed so that it is thick in the front-and-rear direction.

[0134] Moreover, since the linking wall part **63** joining the plurality of standing walls **61** and **62** to each other is formed so that the cross-sectional shape transecting the threaded shaft **41** is an arch shape (see FIG. 5) or a bent shape (see FIG. 7) in which at least a middle part protrudes toward the side away from the threaded shaft **41** or the side close thereto so that it becomes an apex part, the bending stiffness of the linking wall part **63** itself is enhanced effectively. As a result, the bearing member **60** can ensure a sufficient support rigidity toward the threaded shaft **41** while lightening the weight of the bearing member **60**.

[0135] Moreover, since among the plurality of standing walls **61** and **62**, the threaded shaft **41** is fitted and supported in the through hole **61a** of the first standing wall **61** without play, and the threaded shaft **41** is fitted in the through hole **62a** of the second standing wall **62** with play, even when there are a plurality of the standing walls **61** and **62** (and consequently the through holes **61a**, **62a**), the through hole **61a** (bearing hole) for supporting the threaded shaft **41** without play may be formed only in the standing wall(s) **61** which is part of the standing walls, and this eliminates the necessity for strict coaxial precision between the plurality of through holes **61a** and **62a**, thus cutting the machining cost.

[0136] Furthermore, the bearing member **60** is formed from a bent band plate material, and the threaded shaft **41** is fitted and supported in the through hole **61a** of the (first) standing wall(s) **61**, which is said part of the standing walls, via the bearing bush **65**. Because of this, even if the standing wall **61** having the through hole **61a** as the bearing hole has a plate shape and is thin, any decrease in the support rigidity toward the threaded shaft **41** can be minimized.

[0137] Moreover, since the first standing wall(s) **61** is disposed further outside in the axial direction of the threaded shaft **41** than the second standing wall(s) **62**, and the second standing wall(s) **62** has the stopper face **62s**, which engages directly or indirectly (that is, via the support plate **70**) with the nut member **42** and restricts the forward limit or rearward limit of the movable rail U, the bearing member **60** supporting the threaded shaft **41** also functions as a stopper member restricting the forward limit or rearward limit of the movable rail U, thus accordingly simplifying the structure. Furthermore, since the functions are divided such that, among the plurality of standing walls **61** and **62** of the bearing member **60**, the standing wall(s) **61** on the outer side in the axial direction acts as a bearing wall and the standing wall(s) **62** on the inner side in the axial direction acts as stopper means, the burden on each of the standing walls **61** and **62** can be alleviated, thus further lightening the weight.

[0138] The extending walls **61w** and **62w** extending toward the sides opposite from each other in the front-and-rear direction are connectedly provided integrally with the base ends of the first and second standing walls **61** and **62** arranged across a gap in the front-and-rear direction, and the bearing member **60** is joined to the fixed rail L via the extending walls **61w** and **62w**. This enables the support span of the fixed rail L toward the bearing member **60** to be increased due to the extension walls being specially provided, and the support rigidity toward the bearing member **60** can be further enhanced.

[0139] Furthermore, in the present embodiment, the plate-shaped stopper wall parts **71** and **72** through which the threaded shaft **41** extends at a position spaced from the nut member **42** in at least

one of the forward and backward directions (both directions in the embodiment) are fixedly supported on the movable rail U in a cantilever manner, and due to the stopper wall parts **71** and **72** detachably abutting against the stopper face **62s** of the bearing member **60** the forward limit and the rearward limit for the movable rail U are restricted. Since the plate-shaped stopper wall parts **71** and **72** thereby undergo some elastic deformation when they abut against the stopper face **62s**, compared with a structure in which the nut member **42** directly engages with the stopper face **62s** the effect in absorbing impact at the time of engagement is enhanced.

[0140] Moreover, in the present embodiment, the pair of front and rear bearing members **60** are fixed to the fixed rail L across a gap in the front-and-rear direction so as to sandwich the nut member **42** therebetween, the front and rear stopper wall parts **71** and **72**, through which the threaded shaft **41** extends at positions spaced from the nut member **42** in one and the other of the forward and backward directions, are fixed to the movable rail U, and the pair of front and rear stopper wall parts **71** and **72** detachably abut against the stopper faces **62s** of the pair of front and rear bearing members **60**, thus restricting the forward limit and the rearward limit for the movable rail U. Therefore, due to the pair of front and rear stopper wall parts **71** and **72**, through which the threaded shaft **41** extends at positions spaced from the nut member **42** in one and the other of the forward and backward directions, being specially provided a region of an intermediate part of the threaded shaft **41** that becomes free in the center run-out direction can be decreased, thus having an effect in suppressing the center run-out of the threaded shaft **41**.

[0141] Furthermore, the support plate **70** of the present embodiment has the front and rear stopper wall parts **71** and **72** and the intermediate wall part **73** having opposite ends connected to the stopper wall parts **71** and **72**, extending in the front-and-rear direction, and being fixed (e.g. welded) to the movable rail U, and is disposed between the front and rear bearing members **60** within the movable rail U, and the intermediate wall part **73** has the intermediate bent portion **73m** that clasps the nut member **42** fixed to the movable rail U. This enables the single support plate **70**, which has the front and rear stopper wall parts **71** and **72** and exhibits a stopper function in both forward and backward directions, to be formed easily with low cost by press forming a band plate material. Moreover, the support plate **70** can enhance the support strength for the nut member **42** by utilizing the intermediate bent portion **73m**.

[0142] FIG. **8** shows a second embodiment of the present invention. That is, in the first embodiment the housing H is inclined toward the middle side in the seat left-and-right direction in going to the front end part Lf of the fixed rail L with respect to the fixed rail L when viewed from above, but in the second embodiment the housing H is disposed so as to extend toward the middle side in the seat left-and-right direction while being substantially orthogonal to the fixed rail L when viewed from above. The arrangement is otherwise the same as that of the first embodiment, and constituent elements are denoted by the same reference numerals and symbols as those of the corresponding constituent elements of the first embodiment, further explanation being omitted.

[0143] Therefore, in the second embodiment, basically the same effects as those of the first embodiment can also be exhibited and, furthermore, in the second embodiment due to the housing H being substantially orthogonal to the fixed rail L, there is no possibility of the housing H and a portion (e.g. the support frames **7** to **9**) of the fixed rail L fixed to the floor frame F being superimposed on one another in the up-and-down direction, thus further improving the degree of freedom in design. Furthermore, due to the housing H being substantially orthogonal to the fixed rail L when viewed from above, compared with a case in which the housing H is provided along the fixed rail L, the curvature of the electric wire **80** that is drawn out of the housing H and curved toward the fixed rail L side can be further reduced, and there is the advantage that the electric wire **80** can be more smoothly bent, etc.

[0144] FIG. **9** shows a third embodiment of the present invention. In this embodiment, the linking part **51** of the slider **50** has a top wall portion **51t** that covers the upper side of the threaded shaft **41**, and left and right side wall portions **51s** that extend obliquely downward from left and right

ends of the top wall portion **51t** so as to spread out in going toward the tip, inner faces of the top wall portion **51t** and the left and right side wall portions **51s** forming an interference-avoiding portion **50c** having a peak-shaped cross section. The arrangement is otherwise the same as that of the first embodiment, and constituent elements are denoted by the same reference numerals and symbols as those of the corresponding constituent elements of the first embodiment, further explanation being omitted.

[0145] Therefore, in the third embodiment, basically the same effects as those of the first embodiment can also be exhibited and, moreover, in the third embodiment due to the slider **50** having the lower half of the linking part **51** spreading out in going toward the tip and downward interference with the threaded shaft **41** can be avoided without difficulty. Furthermore, since the top wall portion **51t** of the linking part **51** has a relatively small width, a portion of the slider **50** that is exposed and extended from the upper end of the fixed rail **L** can be made small in the left-and-right direction, thus avoiding effectively interference with other objects.

[0146] FIG. **10** shows a fourth embodiment of the present invention. In the first embodiment, the gear box **31** (drive unit **Du**) can be detachably latched with the fixed rail **L** via the plate spring member **90**, but in the fourth embodiment the outer end of the transmission shaft **36** joined to the extending shaft portion **41d** of the threaded shaft **41** via the joint **J** is made to project outward of an outside wall (a lid **312**) of the gear box **31**, and engaging a head part of a bolt **200**, screwed into the projecting end face from the outside, with the projecting end face fixes the gear box **31** to the front end part **Lf** of the fixed rail **L**. The arrangement is otherwise the same as that of the first embodiment, and constituent elements are denoted by the same reference numerals and symbols as those of the corresponding constituent elements of the first embodiment, further explanation being omitted.

[0147] Therefore, in the fourth embodiment, basically the same effects as those of the first embodiment can also be exhibited and, moreover, in the fourth embodiment since the transmission shaft **36** can be used as retaining means for the gear box **31** in cooperation with the bolt **200**, the structure for securing the gear box **31** is accordingly simplified. As an modified example of the fourth embodiment, a structure in which for example the extending shaft portion **41d** of the threaded shaft **41** and the transmission shaft **36** are formed as a unit can be implemented.

[0148] FIGS. **11** and **12** show a fifth embodiment of the present invention. In the first embodiment, the opening at the upper end of the fixed rail **L** is covered only by the floor carpet and not by a molding, but in the fifth embodiment the opening at the upper end of at least one (the right one in the illustrated example) of the right and left fixed rails **L** is formed so as to be blocked by a pair of left and right moldings **14** and **15**. The upper side of the moldings **14** and **15** is covered as necessary by a floor carpet (not illustrated).

[0149] A movable rail **U** of the fifth embodiment is formed so that a pair of movable rail halves **22** and **22'** are non-symmetric in the left and right direction, and the upper half of the movable rail **U** and a part thereof joined to a hanging wall part **100** of a seat base plate are disposed offset toward the seat interior (leftward in FIG. **12**). That is, the upper half and a majority of the lower half of the second movable rail half body **22'**, which is on the seat interior side, form a continuous vertical wall, whereas the lower half of the first movable rail half body **22**, which is on the seat exterior side (rightward in FIG. **12**), includes a top wall portion **22t** that is wide in the left-and-right direction and a side wall portion **22s** that descends vertically from the outer end of the top wall portion **22t**, and not only the nut **45** and the support plate **70** but also part of the bearing member **60** and the threaded shaft **41** are covered by the wide top wall portion **22t**. Due to such offset disposition toward the seat interior side, the upper half of the movable rail **U** and the part thereof joined to the hanging wall part **100** of the seat base plate can be positioned as close to the seat interior side as possible, and there is therefore the advantage that they are hard to see from the seat exterior side.

[0150] For the purpose of receiving the fixed rail **L** a groove-shaped mounting recess **Fa** extending in the front-and-rear direction is formed in the floor frame **F** of the vehicle body, and the bottom

wall part **12** of the fixed rail L is joined (e.g. bolted) to a bottom part of the mounting recess Fa. A recessed or protruding (recessed in the illustrated example) latching part **16** extending in the front-and-rear direction is formed on each of left and right opening edge parts of the mounting recess Fa, and the pair of left and right first and second moldings **14** and **15** are latched with the latching parts **16**, the opening at the upper end of the fixed rail L being covered by mutual cooperation between the first and second moldings **14** and **15**.

[0151] The moldings **14** and **15** are each formed integrally and connectedly from a molding main body **14m**, **15m** that is formed into a strip shape and extends over the entire length of the fixed rail L in a substantially horizontal attitude, and a lip portion **14l**, **15l** that is connectedly provided with the inner edge of the molding main body **14m**, **15m** and is slidably and resiliently in contact under pressure with the upper half of the corresponding movable rail half **22**. The lip portions **14l** and **15l** may be formed as a separate material from that of the molding main body **14m**, **15m** and joined to the molding main body **14m**, **15m** afterward or may be molded integrally with the molding main body **14m**, **15m** from an elastic material. Furthermore, a face of the lip portion **14l**, **15l** that is in sliding contact with the movable rail half body **22** may be coated with a protective film in order to reduce sliding resistance as necessary.

[0152] In particular, the molding main body **14m** of the first molding **14** on the seat exterior side is formed so as to be wide in the left and right direction so that it can cover the top wall portion **22t** on the lower half of the movable rail half body **22** on the same side and the flange portion **13f** at the upper end on the same side of the fixed rail L. A downward-facing first engagement projection portion **14mo** is provided along the outer edge part of the molding main body **14m**, the first engagement projection portion **14mo** engaging with and being in pressure contact with an upper face of the floor frame F on the outer side of the mounting recess Fa. A downward-facing second engagement projection portion **14mi** is provided along the inner edge part of the molding main body **14m**, the second engagement projection portion **14mi** slidably engaging with and being in pressure contact with an upper face of the top wall portion **22t** of the first movable rail half body **22**. At least one (in this embodiment a plurality at intervals in the front-and-rear direction) downward-facing latching piece **14mk** is projectingly provided integrally with a lower face of the molding main body **14m**, the latching piece **14mk** projecting into a gap between an outside face of the fixed rail L and an inside face of the mounting recess Fa, and a latching claw portion **14mka** provided at the tip part of the latching piece **14mk** detachably latching with the latching part **16** on the inside face of the mounting recess Fa.

[0153] On the other hand, the molding main body **15m** of the second molding **15** on the seat interior side is formed so as to be relatively narrow in the left and right direction, the molding main body **15m** mainly covering the flange portion **13f** at the upper end on the same side of the fixed rail L. A downward-facing first engagement projection portion **15mo** is provided along the outer edge part of the molding main body **15m**, the first engagement projection portion **15mo** engaging with and being in pressure contact with an upper face of the floor frame F on the outer side of the mounting recess Fa. A downward-facing second engagement projection portion **15mi** is provided along the inner edge part of the molding main body **15m**, the second engagement projection portion **15mi** engaging with and being in pressure contact with an upper face of the flange portion **13f** at the upper end on the same side of the fixed rail L. At least one (in this embodiment a plurality at intervals in the front-and-rear direction) downward-facing latching piece **15mk** is projectingly provided integrally with a lower face of the molding main body **15m**, the latching piece **15mk** projecting into a gap between the outside face of the fixed rail L and the inside face of the mounting recess Fa, and a latching claw portion **15mka** provided at the tip part of the latching piece **15mk** detachably latching with the latching part **16** on the inside face of the mounting recess Fa.

[0154] In this way, the first molding **14** is latched with and fixed to the mounting recess Fa while making the lip portion **14l** be in pressure contact with the upper half of the first movable rail half body **22** by resiliently latching the latching piece **14mk** with the latching part **16** in a state in which

the first and second engagement projection portions **14mo** and **14mi** are abutted against the upper faces of the floor frame **F** and the top wall portion **22t** respectively. The second molding **15** is latched with and fixed to the mounting recess **Fa** while making the lip portion **151** be in pressure contact with the upper half of the second movable rail half body **22** by resiliently latching the latching piece **15mk** with the latching part **16** in a state in which the first and second engagement projection portions **15mo** and **15mi** are abutted against the upper faces of the floor frame **F** and the fixed rail **L** respectively.

[0155] In the above latched and fixed state, the first and second moldings **14** and **15** can cover in cooperation with each other (mainly the first molding **14**) the opening at the upper end of the fixed rail **L** (and consequently gaps between the threaded shaft **41**, the bearing member **60**, the slider **50**, the fixed rail **L**, and the upper halves of the first and second movable rail halves **22** and **22'**) and can cover a gap between the fixed rail **L** and the mounting recess **Fa**. This enables dirt, dust, and other foreign matter to be prevented effectively from adhering to components such as the threaded shaft **41**, the bearing member **60**, and the slider **50** within the fixed rail **L** or engagement parts between the components, thereby neatly hiding the inside of the fixed rail **L** and enhancing the marketability.

[0156] The shape of the lip portions **141** and **151** of the first and second moldings **14** and **15** may be set so that the lip portions **141** and **151** move toward each other by virtue of self resilience and are in direct contact with each other in a region where the lip portions **141** and **151** do not oppose the upper half of the movable rail **U** or so that they are not in contact but the gap therebetween is very small.

[0157] The arrangement is otherwise the same as that of the first embodiment, and constituent elements are denoted by the same reference numerals and symbols as those of the corresponding constituent elements of the first embodiment, further explanation being omitted.

[0158] Therefore, in the fifth embodiment, basically the same effects as those of the first embodiment can also be exhibited, but in the fifth embodiment due to the first and second moldings **14** and **15** being specially provided an effect in covering the opening at the upper end of the fixed rail **L** is further exhibited.

[0159] In the fifth embodiment, the molding structure covering the opening at the upper end of the fixed rail **L** is provided on one (the right one in the illustrated example) of the left and right fixed rails **L**, but the same molding structure may be provided on the other (the left one in the illustrated example) of the left and right fixed rails **L**. In this case, when the molding structure of the fifth embodiment is applied to one in which the slider **50** retaining the power supply electric wire **80** is slidably provided within the fixed rail **L** as for the fixed rail **L** on the left side in the first embodiment in particular, the lip portions **141** and **151** of the first and second moldings **14** and **15** are made to be in slidable pressure contact not only with the upper half of the movable rail **U** but also with the inner face of the constriction portion **50m** of the slider **50**. In a case in which as for the movable rail **U** of the fifth embodiment the upper halves of the movable rail halves **22** and **22'** are disposed offset toward the seat interior side, it is desirable for the constriction portion **50m** of the slider **50** to also be disposed offset toward the seat interior side.

[0160] Embodiments of the present invention are explained above, but the present invention is not limited to the above-mentioned embodiments and may be modified in a variety of ways as long as the modifications do not depart from the gist of the present invention.

[0161] For example, in the embodiments, the automobile seat **S** is illustrated as a seat, but the present invention can be applied to a seat that is used in a vehicle (e.g. a railway vehicle) other than an automobile, a seat used in a vessel (e.g. a ship, an airplane) other than the vehicle, or a seat used in one other than a vessel. When it is used as an automobile seat, the seat may be a front seat or a rear seat.

[0162] In the embodiment, the power supply electric wire **80** (wire harness) is protected by being inserted into the bellows-shaped protective tube **81**, but the protective tube **81** may have at least

flexibility and have strength that can protect the electric wire **80** and may not always be formed into a bellows shape. Alternatively, another embodiment in which the protective tube **81** is omitted is also possible.

[0163] Furthermore, in the embodiments the threaded shaft **41** is rotatably supported on the fixed rail L on the floor side via the bearing member **60**, whereas the nut member **42** screwed around the threaded shaft **41** is fixed to the movable rail U on the seat side, and the motor M and the transmission mechanism **30** for rotating the threaded shaft **41** are mounted on the fixed rail L (on the vehicle body side). However, either one of the threaded shaft **41** and the nut member **42** may be on the rotation side or the fixed side, for example, the threaded shaft **41** may be fixedly supported on the fixed rail L via the bearing member **60** whereas the nut member **42** may be rotatably supported on the movable rail U and the motor M and the transmission mechanism **30** for rotating the nut member **42** may be mounted on the seat S side.

[0164] Moreover, the vertical positional relationship between the threaded shaft **41** and the nut member **42** is not limited to that in the embodiments, and for example the threaded shaft **41** may be rotatably supported on the movable rail U on the upper side via a bearing member whereas the nut member **42** may be fixed to the fixed rail L on the lower side and a motor and a transmission mechanism for driving the threaded shaft **41** may be mounted on the seat side. In this case also, the arrangement for the rotation side and the fixed side may be reversed, and for example the threaded shaft **41** may be fixed and supported on the movable rail U via a bearing member whereas the nut member **42** may be rotatably supported on the fixed rail L and a motor and a transmission mechanism for rotating the nut member **42** may be mounted on the vehicle body side.

Claims

1. An adjusting device of front and rear positions of a seat, the device comprising a fixed rail that is fixed to a floor and extends in a front-and-rear direction, a seat support body that is fixed to the seat and supported on the fixed rail so that the seat support body can slide in the front-and-rear direction, a drive device that can drive the seat support body in the front-and-rear direction with respect to the fixed rail, and a power supply device that supplies power to an electrical component attached to the seat, characterized in that: the drive device has a motor and a transmission member that is disposed so as to pass longitudinally through an interior of the fixed rail and is involved in transmission of driving force from the motor to the seat support body, the power supply device includes a housing that houses an electric wire for power supply, and a slider that is linked to the seat support body and can slide within the fixed rail, the electric wire being drawn out from the housing and retained by the slider so that the electric wire can slide within the fixed rail, and the slider has an interference-avoiding portion that avoids interference with the transmission member within the fixed rail.
