

US Patent & Trademark Office

Patent Public Search | Text View

United States Patent	12391159
Kind Code	B2
Date of Patent	August 19, 2025
Inventor(s)	Miyawaki; Kazuya et al.

Vehicle seat

Abstract

Provided is a vehicle seat with a structure enabling a rockable moving piece to be disposed in a seat face in a well-fitting manner. A vehicle seat in which a rocking means having a drive mechanism and a moving piece for conveying rocking movement of the drive mechanism to a seated person is disposed in a through hole obtained by hollowing out a portion of a seat face of a seat cushion, wherein: a recess which is recessed in the thickness direction so as to surround the through hole is disposed in the seat face of the seat cushion; and the moving piece is shaped so that the bottom surface side follows the recess.

Inventors:	Miyawaki; Kazuya (Tochigi-ken, JP), Yamauchi; Naoto (Tochigi-ken, JP)
Applicant:	TS TECH CO., LTD. (Asaka, JP)
Family ID:	1000008762793
Assignee:	TS TECH CO., LTD. (Asaka, JP)
Appl. No.:	18/312259
Filed:	May 04, 2023

Prior Publication Data

Document Identifier	Publication Date
US 20230271537 A1	Aug. 31, 2023

Foreign Application Priority Data

JP	2019-123708	Jul. 02, 2019
----	-------------	---------------

Related U.S. Application Data

Publication Classification

Int. Cl.: **B60N2/02** (20060101); **B60N2/00** (20060101); **B60N2/22** (20060101); **B60N2/50** (20060101); **B60N2/56** (20060101); **B60N2/90** (20180101)

U.S. Cl.:

CPC **B60N2/5642** (20130101); **B60N2/0022** (20230801); **B60N2/0025** (20230801); **B60N2/0033** (20230801); **B60N2/501** (20130101); B60N2210/30 (20230801); B60N2210/42 (20230801); B60N2210/48 (20230801)

Field of Classification Search

CPC: B60N (2/0022); B60N (2/0244); B60N (2/0268); B60N (2/0273); B60N (2/026); B60N (2/0023)

References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
5765803	12/1997	Graham	267/221	B60N 2/544
8872640	12/2013	Horseman	340/576	A61B 5/1114
9090188	12/2014	Imamura	N/A	B60N 2/986
9156388	12/2014	Nakanishi	N/A	B60N 2/688
10210409	12/2018	Migneco	N/A	A61B 5/18
10391902	12/2018	Gonzalez Uribe	N/A	B60N 2/68
10399463	12/2018	Sugiyama	N/A	B60N 2/0244
10926773	12/2020	Vulcu	N/A	A61B 5/6893
10940872	12/2020	Alexiou	N/A	G06F 3/016
11059388	12/2020	Sugiyama	N/A	B60N 2/0244
2002/0145321	12/2001	Brightbill	297/312	B60N 2/50
2003/0085602	12/2002	Ogino	297/331	B60N 2/1892
2008/0236275	12/2007	Breed	73/290V	B60R 21/015
2009/0261979	12/2008	Breed	340/576	B60N 2/0028
2013/0241254	12/2012	Sugiyama	297/260.1	B60N 2/02
2014/0028074	12/2013	Imamura	297/452.18	A47C 7/18
2015/0375638	12/2014	Farooq	296/65.18	B60N 2/06
2017/0225591	12/2016	Tobata	N/A	B60N 2/10
2017/0349061	12/2016	Benson	N/A	B60N 2/1615
2018/0022235	12/2017	Sugiyama	297/284.9	B60N 2/0244
2019/0300020	12/2018	Alexiou	N/A	B60N 2/5891
2019/0337411	12/2018	Sugiyama	N/A	B60N 2/99
2019/0344043	12/2018	Migneco	N/A	A61B 5/168
2020/0353934	12/2019	Vulcu	N/A	B60N 2/0277
2021/0354605	12/2020	Gallagher	N/A	B60N 2/62

2022/0218287	12/2021	Komine	N/A	G16H 50/20
2022/0363173	12/2021	Miyawaki	N/A	B60N 2/646
2023/0136197	12/2022	Gilmore	267/131	B60N 2/0224

FOREIGN PATENT DOCUMENTS

Patent No.	Application Date	Country	CPC
61-139528	12/1985	JP	N/A
H082301	12/1995	JP	N/A
2014-151769	12/2013	JP	N/A
2017-061221	12/2016	JP	N/A
2018-086996	12/2017	JP	N/A

OTHER PUBLICATIONS

International Search Report and Written Opinion with English Translation issued in PCT/JP2020/023373, dated Jul. 28, 2020 (11 pages). cited by applicant
Japanese Office Action (w/ English translation) for corresponding Application No. 2023-191454, mailed Nov. 26, 2024, 10 pages. cited by applicant

Primary Examiner: Kim; Shin H

Attorney, Agent or Firm: Dority & Manning, P.A.

Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS (1) This application is a continuation of U.S. patent application Ser. No. 17/623,860, filed on Dec. 30, 2021, which is the U.S. National Stage entry of International Application No. PCT/JP2020/023373, filed on Jun. 15, 2020, which claims priority to Japanese Patent Application No. 2019-123708, filed on Jul. 2, 2019, all of which are incorporated herein by reference in their entireties for all purposes.

TECHNICAL FIELD

(1) The present invention relates to a vehicle seat that is installed in a conveyance such as a vehicle.

BACKGROUND ART

(2) JP 2018-086996 A discloses a vehicle seat installed in a conveyance. This vehicle seat eliminates the lack of exercise of a seated person by rocking the seat portion on which the seated person sits.

SUMMARY OF THE INVENTION

(3) However, the above-described vehicle seat has a structure in which a rockable portion (movable portion) of a seat portion largely protrudes from a seat surface of the vehicle seat. For this reason, there is a concern that the vehicle seat may give an uncomfortable feeling to a seated user. In addition, when the size of the movable portion is increased in order to more effectively transmit the rocking motion to the seated person, the exterior appearance of the movable portion is increased, which causes a problem that the movable portion becomes conspicuous.

(4) An object of the present invention is to provide a vehicle seat having a rockable seat portion, in which a rockable movable portion is disposed so as to be well accommodated in a seat surface.

(5) According to an aspect of the present invention, there is provided a vehicle seat including: a seat back configured to support a back of a seated person; a seat cushion configured to support buttocks of the seated person; a frame configured to support the seat cushion and the seat back; a through hole formed by hollowing out part of a seat surface of the seat cushion or the seat back, the through hole communicating with the frame; and a rocking unit including a drive mechanism fixed to a

portion of the frame that corresponds to the through hole and a movable portion supported by the drive mechanism, the movable portion being configured to abut against the seated person and transmit rocking motion of the drive mechanism to the seated person, wherein the seat surface is provided with a recessed portion recessed in a thickness direction, the recessed portion being disposed around the through hole, and the movable portion extends to a periphery of the through hole, and a back side (a lower surface) of the movable portion is formed in a shape along the recessed portion.

(6) According to the vehicle seat of the above aspect, the movable portion can be disposed so as to be accommodated well in the seat surface.

Description

BRIEF DESCRIPTION OF DRAWINGS

- (1) FIG. 1 is a perspective view of a vehicle seat according to a first embodiment of the present invention;
- (2) FIG. 2 is a rear view of the vicinity of a lower end portion of the vehicle seat of FIG. 1;
- (3) FIG. 3 is a perspective view of a seat cushion from which a rocking unit of FIG. 1 is removed;
- (4) FIG. 4 is a plan view of the rocking unit of FIG. 1;
- (5) FIG. 5 is a front view of the rocking unit of FIG. 3;
- (6) FIG. 6 is a side view of the rocking unit of FIG. 3;
- (7) FIG. 7 is a perspective view of a seat frame of the seat cushion of FIG. 1;
- (8) FIG. 8 is an exploded cross-sectional view taken along line VIII-VIII of FIG. 1;
- (9) FIG. 9 is an enlarged cross-sectional view of a contact portion between the movable portion and a recessed portion of the seat cushion in FIG. 8;
- (10) FIG. 10 is an exploded cross-sectional view taken along line X-X of FIG. 1;
- (11) FIG. 11 is a schematic cross-sectional view illustrating a state in which a seated person is seated on the vehicle seat of FIG. 1;
- (12) FIG. 12 is a partially enlarged cross-sectional view of a seat cushion and a movable portion according to a second embodiment;
- (13) FIG. 13 is a plan view of a movable portion according to a third embodiment; and
- (14) FIG. 14 is a plan view of the inside of the seat cushion according to a fourth embodiment.

DESCRIPTION OF THE INVENTION

(15) Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings. Note that, in the following description, the direction of “up and down”, the direction of “left and right”, and the direction of “front and rear” refer respectively to the “up and down” direction, the “left and right” direction, and the “front and rear” direction as viewed from a seated person H (see FIG. 11) seated on the vehicle seat 10.

First Embodiment

(16) As shown in FIG. 1, a vehicle seat 10 according to the present embodiment includes a seat cushion 12, a seat back 14, and a rocking unit 16. The seat cushion 12 is a seat portion that supports the buttocks of a seated person H (see FIG. 11). The seat back 14 is a backrest. The rocking unit 16 is a member disposed in the seat cushion 12.

(17) The seat cushion 12 includes a seat frame 30 (see FIG. 7), a cushion pad 25a (see FIG. 10), and a skin 25b. The cushion pad 25a is supported by the seat frame 30. The skin 25b covers the cushion pad 25a. The seat back 14 is attached to a rear end portion of the seat cushion 12. Similarly to the seat cushion 12, the seat back 14 includes a seat frame 73, a cushion pad 71, and a skin 72. The cushion pad 71 is supported by the seat frame 73. The skin 72 covers the cushion pad 71. The skin 25b and the skin 72 are made of, for example, a material such as suede fabric or synthetic leather having a good texture.

(18) The seat frame **30** of the vehicle seat **10** is disposed on a slide mechanism **60**. The slide mechanism **60** is capable of adjusting the position of the vehicle seat **10** in the front-rear direction. The slide mechanisms **60** are disposed on both left and right side portions of the vehicle seat **10**. As shown in FIG. **1**, the vehicle seat **10** includes a first cover member **34**, a second cover member **36**, and a third cover member **38** in order to prevent foreign matter from entering the seat frame **30**, the seat frame **73**, and the slide mechanisms **60**. The first cover member **34** mainly covers the seat frame **30**. The second cover member **36** covers the slide mechanisms **60**. A pair of the second cover members **36** are disposed on both side portions of the vehicle seat **10**. The third cover member **38** covers the seat frame **73** at the back portion of the seat back **14**. As shown in FIG. **2**, the first cover member **34**, the second cover member **36**, and the third cover member **38** also cover the back portion of the vehicle seat **10**.

(19) As shown in FIG. **11**, the rocking unit **16** is a device that rocks the pelvis portion of the seated person H while supporting the buttocks of the seated person H. A part of the lower side of the rocking unit **16** is disposed inside the seat cushion **12**. As shown in FIG. **5**, the rocking unit **16** includes a movable portion **18** and a drive mechanism **50**. The movable portion **18** abuts against the seated person H. The drive mechanism **50** is disposed below the movable portion **18**. Details of the rocking unit **16** will be described later. The rocking unit **16** may be provided on the seat back **14**. Although not particularly limited, in the present embodiment, as shown in FIG. **1**, an example in which the rocking unit **16** is provided in the seat cushion **12** will be described.

(20) The vehicle seat **10** shown in FIG. **1** is installed, for example, in the driver's seat of a vehicle. The rocking unit **16** rocks the seated person H to thereby exercise the seated person H and eliminate the lack of exercise. Further, the rocking unit **16** reduces fatigue by giving a massage effect to the seated person H. Further, the rocking unit **16** causes the seated person H, i.e., the driver, to pay attention to driving, when the seated person H is distracted.

(21) Hereinafter, details of the seat cushion **12** and the rocking unit **16** of the vehicle seat **10** will be described in detail. As shown in FIGS. **3** and **4**, the seat cushion **12** has a recessed portion **20** for mounting the rocking unit **16** and a through hole **22** for installing the drive mechanism **50** of the rocking unit **16**. The recessed portion **20** has a shape corresponding to the planar shape of the movable portion **18** so as to accommodate the movable portion **18** with a good fit. That is, the recessed portion **20** has a front edge portion **20e1** and a front edge portion **20e2** as edges on the front side. The front edge portion **20e1** and the front edge portion **20e2** extend forward while being inclined with respect to the left-right direction. In the recessed portion **20**, the front edge portions **20e1** and **20e2** form a substantially triangular shape that protrudes forward while narrowing in the width direction. The recessed portion **20** further includes a front recess **20a** corresponding to a front end **18a** of the movable portion **18**, a right recess **20b** corresponding to a right end **18b** of the movable portion **18**, a left recess **20c** corresponding to a left end **18c** of the movable portion **18**, and a rear recess **20d** corresponding to a rear end **18d** of the movable portion **18**. The front recess **20a** has a larger area than the right recess **20b**, the left recess **20c**, and the rear recess **20d**.

(22) As shown in the cross-sectional view of FIG. **8**, the recessed portion **20** has an inclined surface which causes the depth of the recessed portion in the thickness direction to gradually increase toward the central through hole **22**. The recessed portion **20** is recessed most deeply in the thickness direction at a boundary with the through hole **22**.

(23) As shown in FIG. **3**, the through hole **22** is formed substantially at the center of the recessed portion **20**. The through hole **22** has a structure in which a cushion pad **25a** configuring the seat cushion **12** is hollowed out in the thickness direction. As shown in FIG. **8**, the through hole **22** forms a space for installing the drive mechanism **50** of the rocking unit **16**. The through hole **22** has a rectangular planar shape having dimensions similar to the planar shape of the rocking unit **16**. The shape of the through hole **22** is not particularly limited to a rectangular shape. The shape of the through hole **22** is appropriately set according to the shape of the drive mechanism **50** of the rocking unit **16**.

(24) As shown in FIG. 3, the front recess **20a** has a larger horizontal dimension, in the recessed portion **20**. Accordingly, the front recess **20a** has a friction reducing portion **23**. The friction reducing portion **23** is made of cloth having a friction coefficient smaller than that of the skin **25b** of the seat cushion **12**. As the cloth having a smaller friction coefficient, the friction reducing portion **23** can use, for example, cloth made of a fiber having a small friction coefficient such as a nylon fiber, a high molecular weight polyethylene fiber, or a fluororesin fiber. The recessed portion **20** other than the friction reducing portion **23** is covered with the skin **25b**. The cushion pad **25a** is not exposed from the recessed portion **20**.

(25) The skin **25b** is fixed to the cushion pad **25a** at a boundary between the recessed portion **20** and the through hole **22**. The boundary between the recessed portion **20** and the through hole **22** is most recessed in the recessed portion **20**. As shown in FIG. 8, the cushion pad **25a** has a wire **21b** embedded in the vicinity of the boundary between the recessed portion **20** and the through hole **22** of the cushion pad **25a**. The wire **21b** is disposed so as to surround the periphery of the through hole **22**. An end portion of the skin **25b** is fixed to the wire **21b** via a C-shaped clip **21a**. As shown in FIG. 3, when one end of the skin **25b** is fixed to the boundary between the recessed portion **20** and the through hole **22**, a smooth surface without irregularities is formed on the inclined portion between the edge and the through hole **22** of the recessed portion **20**. Further, a force applied to the clip **21a** from the outside of the vehicle seat **10** is suppressed by attaching the clip **21a** to the boundary between the recessed portion **20** and the through hole **22**. This structure reduces the load on the clip **21a**.

(26) The cushion pad **25a** may be exposed on the side wall of the through hole **22**. The skin **25b** only has to be fixed at a portion other than the inclined portion of the recessed portion **20**. The skin **25b** may cover an inner side portion of the through hole **22**. In the example of FIG. 3, the skin **25b** covers the inner surface of the rear end portion of the through hole **22**. In this case, the skin **25b** is fixed to the cushion pad **25a** by the clip **21a**, near the bottom of the through hole **22**. The skin **25b** may pass through the through hole **22** and be folded back and fixed to the back side of the cushion pad **25a**.

(27) As shown in FIGS. 5 and 6, the rocking unit **16** includes a movable portion **18** disposed at an upper end thereof and a drive mechanism **50** for supporting and driving the movable portion **18**. A portion of an upper surface **18f** of the movable portion **18** abuts against the seated person H (see FIG. 11). The movable portion **18** transmits the rocking motion generated by the drive mechanism **50** to the seated person H.

(28) As shown in FIG. 4, the movable portion **18** has a substantially triangular shape in plan view. The movable portion **18** has a front edge **18e1** and a front edge **18e2** that are inclined in plan view. The front edge **18e1** and the front edge **18e2** protrude toward the front end **18a** while narrowing in the left-right direction. The movable portion **18** has the right end **18b** and the left end **18c** in addition to the front end **18a**. The front end **18a**, the right end **18b**, and the left end **18c** have a rounded shape. The movable portion **18** has the rear end **18d** linearly extending in the left-right direction at a rear end portion thereof. Since the movable portion **18** is formed in a substantially triangular shape which is rounded as a whole, even when motion of the front end **18a** is stopped in a state of being inclined from the center in the left-right direction, it is possible to reduce a visual sense of discomfort to the seated person H and an uncomfortable feeling of the seated person H seating the seat.

(29) As shown in FIG. 8, the movable portion **18** further includes a support body **42** that receives the rocking displacement of the drive mechanism **50**, a cushion pad **48** that covers the upper side of the support body **42**, and a skin **46** that covers the outer surface of the cushion pad **48**. The cushion pad **48** has flexibility to the extent that cushioning properties equivalent to those of the surrounding seat cushion **12** are exhibited. The skin **46** covering the cushion pad **48** is made of a material equivalent to that of the skin **25b** of the seat cushion **12**.

(30) The support body **42** comprises a flexible plate **41** in contact with the lower end of the cushion

pad **48** and a rigid member **43** disposed under the flexible plate **41**. The rigid member **43** includes a plate-shaped upper end portion **43a** curved in a concave shape, and a column portion **43b** protruding downward from a central portion of the upper end portion **43a**. The column portion **43b** is brought into contact with a shaft member **54** at an arc-shaped contact surface, thereby causing an inclined displacement and a rotational displacement around the axis of the column portion **43b**.

(31) The flexible plate **41** includes a plurality of protrusions **41a** protruding toward an upper end portion **43a** of the rigid member **43**. The protrusion **41a** slides along the concave surface of the rigid member **43** while abutting against the upper end portion **43a** of the rigid member **43**. The flexible plate **41** converts part of displacement due to inclination of the rigid member **43** into displacement in the horizontal direction through sliding of the protrusion **41a**. The flexible plate **41** is a plate-shaped member made of a flexibly deformable resin material. When the movable portion **18** is displaced and pressed against the recessed portion **20**, the flexible plate **41** is flexibly deformed together with the cushion pad **48**. As a result, the ability of the movable portion **18** to follow the recessed portion **20** is improved, and smooth rocking motion of the movable portion **18** becomes possible. Since the movable portion **18** includes the flexible plate **41** and the rigid member **43**, it is possible to perform a twisting operation and a swinging operation in which a horizontal displacement and a rotational displacement around an axis are combined.

(32) A lower surface **18g** of the movable portion **18** is covered with a friction reducing portion **44** made of cloth having a friction coefficient smaller than that of the skin **46**. The friction reducing portion **44** is joined to an end portion of the skin **46** on the lower surface of the movable portion **18** by sewing. The friction reducing portion **44** extends to the vicinity of the column portion **43b** of the rigid member **43** of the movable portion **18**. The end portion of the friction reducing portion **44** is preferably extended to the inner side of the clip **21a** of the skin **25b** of the cushion pad **25a**. In this way, by stretching the friction reducing portion **44** inward, the movable portion **18** can prevent foreign matter from entering the internal structure. The end portion of the friction reducing portion **44** is fixed to the rigid member **43** by, for example, screwing.

(33) The friction reducing portion **44** is formed of, for example, cloth made of a fiber having a small friction coefficient such as a nylon fiber, a high molecular weight polyethylene fiber, or a fluororesin fiber. The friction reducing portion **44** reduces frictional resistance between the lower surface **18g** of the movable portion **18** and the recessed portion **20** of the seat cushion **12**, and enables smooth rocking motion of the movable portion **18**.

(34) The drive mechanism **50** includes a motor **52** and a shaft member **54** that transmits a rotational operation of the motor **52** to the movable portion **18** as a rocking displacement. The shaft member **54** includes a gear, a screw shaft, an eccentric shaft member, and the like. The shaft member **54** causes a rocking displacement including a predetermined twist operation and swing operation in the movable portion **18**.

(35) The rocking unit **16** is mounted on the seat cushion **12** through the through hole **22**. The drive mechanism **50** of the rocking unit **16** is inserted into the through hole **22** of the seat cushion **12**. The drive mechanism **50** is housed in a housing portion **24** of the seat frame **30**. The bottom portion of the drive mechanism **50** is fixed to the bottom portion of the housing portion **24** by fastening bolts. The drive mechanism **50** includes a motor **52**. The motor **52** is disposed so as to avoid a position overlapping the lower side of the recessed portion **20**. The drive mechanism **50** can be made compact by arranging the large-sized motor **52** at a position not overlapping with the recessed portion **20**. Such a drive mechanism **50** enables the seat cushion **12** to be made thinner. Since the motor **52** has a predetermined thickness, when the seated person H sits on the seat, there is a concern that the seated person H may feel uncomfortable due to the hard protruding portion hitting the leg of the seated person. As such, it is preferable that the motor **52** of the drive mechanism **50** be disposed rearward of the shaft member **54** as shown in the drawings.

(36) As shown in FIG. 7, the seat frame **30** has the housing portion **24**. The housing portion **24** is disposed at a portion corresponding to the through hole **22** of the seat cushion **12**. The housing

portion **24** has a rectangular partition wall **24A** surrounding the periphery. The partition wall **24A** of the housing portion **24** is joined onto an attachment plate **24B** installed on the seat frame **30**. The partition wall **24A** has a size equal to or larger than that of the through hole **22**. The partition wall **24A** communicates with the through hole **22**. The partition wall **24A** prevents dust or the like from entering the drive mechanism **50**. The housing portion **24** is held between the pair of side frames **31**.

(37) The partition wall **24A** has a fan **56** at a rear end portion thereof. The fan **56** dissipates heat generated by the motor **52** inside the partition wall **24A** to the outside. The fan **56** prevents heat accumulation of the motor **52**. In this way, the fan **56** prevents a reduction in power of the motor **52** due to overheating. The fan **56** is disposed away from the rear end portion of the first cover member **34** shown in FIG. **2**. Such an arrangement of the fan **56** facilitates spreading of exhaust air of the fan **56** into the first cover member **34**.

(38) As shown in FIG. **10**, the fan **56** is preferably disposed at a position outside the recessed portion **20** of the seat cushion **12**. This arrangement prevents interference between the fan **56** and the recessed portion **20** and allows for compact storage of the fan **56** inside the seat cushion **12**.

(39) As shown in FIG. **9**, the movable portion **18** is disposed in the recessed portion **20** of the seat cushion **12**. Since the recessed portion **20** is formed along the lower surface side of the movable portion **18**, most of the movable portion **18** is accommodated in the recessed portion **20**. Therefore, the upper surface **18f** of the movable portion **18** does not largely protrude from a seat surface **12a** of the seat cushion **12**, and the upper surface **18f** has substantially the same level as the seat surface **12a**. In this manner, the movable portion **18** is disposed so as to be accommodated in the seat cushion **12** with a good fit.

(40) As shown in FIG. **10**, the vehicle seat **10** includes an angle adjustment member so that the seated person H can sit on the seat cushion **12** in which the movable portion **18** is mounted, without a feeling of strangeness or uncomfortable feeling. The angle adjustment member includes a front spacer **65** and a rear spacer **69** that are disposed between the slide mechanism **60** and the seat frame **30**.

(41) The lower end of the front spacer **65** is joined to the vicinity of the front end of a slider **63** that slides on a slide rail **61**, and the upper end thereof is joined to the front portion of the seat frame **30**. The lower end of the rear spacer **69** is joined to the vicinity of the rear end of the slider **63**, and the upper end thereof is joined to the rear portion of the seat frame **30**. The front spacer **65** is higher than the rear spacer **69**, and is arranged to lift the front side of the seat cushion **12** upward. The front spacer **65** and the rear spacer **69** are fastened to the seat frame **30** and the slider **63** by bolting, and can be easily replaced with other spacers having a desired height.

(42) The vehicle seat **10** of the present embodiment is configured as described above, and operation thereof will be described below.

(43) As shown in FIG. **11**, in the vehicle seat **10**, the movable portion **18** of the rocking unit **16** is mounted on the seat cushion **12** in a manner of being accommodated in the recessed portion **20** of the seat cushion **12**. The shape of the recessed portion **20** is formed to be deeper in the thickness direction along the shape of the bottom portion of the movable portion **18**. As a result, the upper surface **18f** of the movable portion **18** is well disposed in the seat cushion **12** in a manner that the upper surface **18f** is substantially flush with the seat surface **12a** of the seat cushion **12**. Even though the seat cushion **12** has the large rocking unit **16**, the seated person H can sit on the vehicle seat **10** with a comfortable feeling similar to that of sitting on a normal seat cushion **12**. The peripheral portion of the movable portion **18** is constituted by the flexible plate **41** and the cushion pad **48**. Therefore, the movable portion **18** is flexibly recessed along with the rocking motion of the rocking unit **16**, and thus the movable portion **18** can be rocked even in the recessed portion **20**.

(44) In the vehicle seat **10**, the rocking unit **16** rocks around the column portion **43b** where the drive mechanism **50** and the movable portion **18** abut. The position of the column portion **43b** is disposed at a position directly below a hip point N which is the center of the rotation center points

of the left and right thighs with respect to the torso of the seated person H. Thus, the rocking unit **16** can rock the seated person H efficiently. In addition, since the movable portion **18** is formed to have a large area expanding outward from the through hole **22**, it is possible to apply rocking displacement to a wide area of the buttocks and thighs of the seated person H, and thus it is possible to rock the seated person H efficiently.

(45) The vehicle seat **10** of the present embodiment has the following effects.

(46) There is provided a vehicle seat including: a seat back **14** configured to support a back of a seated person H; a seat cushion **12** configured to support buttocks of the seated person H; a seat frame **30, 73** configured to support the seat cushion **12** and the seat back **14**; a through hole **22** formed by hollowing out part of a seat surface **12a** of the seat cushion **12** or the seat back **14**, the through hole communicating with the seat frame **30**; and a rocking unit **16** including a drive mechanism **50** fixed to a portion of the seat frame **30** that corresponds to the through hole **22** and a movable portion **18** supported by the drive mechanism **50**, the movable portion being configured to abut against the seated person H and transmit rocking motion of the drive mechanism **50** to the seated person H. The seat surface **12a** is provided with a recessed portion **20** recessed in a thickness direction, the recessed portion being disposed around the through hole **22**. The movable portion **18** extends to a periphery of the through hole **22**. A lower surface **18g** of the movable portion **18** is formed in a shape along the recessed portion **20**.

(47) With the above-described configuration, the upper surface **18f** of the movable portion **18** can be accommodated so as to be substantially flush with the seat surface of the seat cushion **12** or the seat back **14**. As a result, even when a large movable portion **18** is provided, the seated person H can be seated on the vehicle seat **10** without a sense of discomfort.

(48) In the above vehicle seat **10** described above, the recessed portion **20** may have an inclined surface which causes a depth of the recessed portion in the thickness direction to gradually increase as the depth of the recessed portion is closer to the through hole **22**. With such a configuration, the movable portion **18** can be accommodated compactly in the seat cushion **12** or the seat back **14**.

(49) In the above vehicle seat **10**, the movable portion **18** includes the rigid member **43** provided on the lower surface **18g** side and connected to the drive mechanism **50**, the flexible member (the cushion pad **48** and the flexible plate **41**) provided above the rigid member **43**, and the skin **46** (the friction reducing portion **44**) covering the outer surfaces of the flexible member and the rigid member **43**. At least an end portion of a peripheral edge of the movable portion **18** in the lower surface **18g** of the movable portion **18** is formed of the flexible member (the cushion pad **48** and the flexible plate **41**). Accordingly, the movable portion **18** is easily bent, and it is possible to improve the followability to the inclined surface of the recessed portion **20** at the time when the movable portion **18** is rocked.

(50) In the above vehicle seat **10**, the lower surface **18g** side of the movable portion **18** may be covered with the friction reducing portion **44** having a friction coefficient smaller than that of the skin **25b** constituting the seat surface **12a**. With this configuration, the movable portion **18** can be easily rocked, and the rocking displacement of the drive mechanism **50** can be efficiently transmitted to the seated person H.

(51) In the vehicle seat **10** described above, the seat back **14** and the seat cushion **12** each may include a cushion pad **25a, 71** fixed to the seat frame **30, 73**, and a skin **25b, 72** covering the cushion pad **25a, 71**, and the skins **25b, 72** may be fixed to end portions of the through holes **22**. With this configuration, it is possible to prevent a force from being applied from the outside of the vehicle seat **10** to the fixed portions of the skins **25b** and **72**.

(52) In the vehicle seat **10** described above, the drive mechanism **50** may include the motor **52** that operates the movable portion **18**, and the seat frame **30** may be provided with a heat dissipation member which is located at a position facing the motor **52**. With this configuration, it is possible to prevent a decrease in power of the motor **52** due to heating.

(53) In the vehicle seat **10** described above, the heat dissipation member may include a fan **56** that

supplies cooling air, and the rotation center of the fan **56** may be disposed rearward of the recessed portion **20**. With this configuration, since the fan **56** is disposed so as to avoid the recessed portion **20**, interference between the recessed portion **20** and the fan **56** can be prevented, and the structure can be made compact.

(54) The vehicle seat **10** described above may include the first cover member **34** that covers the entire periphery of the side portion of the seat frame **30**, and a space may be provided between the heat dissipation member (fan **56**) and the first cover member **34**. Thus, the heat of the motor **52** can be efficiently dissipated through the fan **56**.

(55) In the vehicle seat **10** described above, the drive mechanism **50** may include the motor **52** that operates the movable portion **18**, and the motor **52** may be provided at a position that avoids the recessed portion **20**. With this configuration, it is possible to prevent the thick motor **52** from protruding to the cushion pad **25a** and giving a sense of discomfort to the seated person H.

(56) In the vehicle seat **10** described above, the movable portion **18** and the recessed portion **20** may be formed in a substantially triangular shape with rounded vertices in a plan view, and one of the vertices may be disposed forward. With such a configuration, even when the movable portion **18** stops in an inclined state, it is possible to suppress a sense of discomfort given to the seated person H in terms of visual and sitting comfort.

Second Embodiment

(57) As shown in FIG. **12**, in this embodiment, a recessed portion **20A** and the lower surface side of a movable portion **18A**, of the seat cushion **12**, are different in shape from the recessed portion **20** and the movable portion **18** of the first embodiment. The other parts are the same. The same components are denoted by the same reference numerals, and detailed description thereof will be omitted.

(58) The recessed portion **20A** is formed to be inclined so as to become deeper in the thickness direction as it approaches the through hole **22**. In the present embodiment, the recessed portion **20A** is formed in a stepped shape by a plurality of stepped portions, and is configured to become deeper in the thickness direction as approaching the through hole **22** by the stepped portions. The lower surface **18g** side of the movable portion **18A** is formed in a stepped shape in accordance with the shape of the recessed portion **20A**. The movable portion **18A** is accommodated in the recessed portion **20A** such that the stepped portions of the movable portion **18A** and the stepped portions of the recessed portion **20A** are aligned with each other.

(59) According to the movable portion **18A** and the recessed portion **20A** of the present embodiment, the same effects as those of the movable portion **18** and the recessed portion **20** of the first embodiment can be obtained.

Third Embodiment

(60) As shown in FIG. **13**, a movable portion **18B** of the present embodiment includes, on an upper surface **18f** thereof, a sensor **83** that acquires biological information of the seated person H. The sensor **83** may be, for example, a strain sensor that measures the weight of the seated person H. In addition, the sensor **83** may be a strain sensor or a piezoelectric sensor that detects vibration caused by heartbeat or respiration of the seated person H. Further, the sensor **83** may be a temperature sensor that detects the body temperature of the seated person H. Further, the sensor **83** may be an electric field sensor or a magnetic sensor that detects a nerve signal or a myoelectric signal of the seated person H.

(61) When a plurality of sensors **83** are provided, they may be configured as shown in the figure. Vertical wirings **81** and horizontal wirings **82** form a wiring network **80** in a matrix shape, and sensors **83** are disposed at intersections of the vertical wirings **81** and the horizontal wirings **82**. A selector (not shown) is connected to the vertical wirings **81** and the horizontal wirings **82**, and the selector outputs a detection signal of a predetermined sensor **83**. An electric signal from the sensor **83** can be sent to a control circuit (not shown) through a wiring **84**.

(62) According to the present embodiment, the biological information of the seated person H can be

detected even if the movable portion **18B** is provided. The biological information can be used, for example, to give the seated person H an appropriate rocking by the movable portion **18B**.

Fourth Embodiment

(63) As shown in FIG. **14**, in the present embodiment, a heater **88** is disposed around the recessed portion **20** of a seat cushion **12B**. The heater **88** is formed of a heating wire that generates heat by an electric current flowing through the heating wire, and is routed around the recessed portion **20** as shown in the drawing. The heater **88** is disposed between the cushion pad **25a** and the skin **25b**. One end and the other end of the heater **88** are connected to connection terminals **89** at a rear end portion of the seat cushion **12**. An electric current is supplied to the heater **88** from a vehicle or the like in which the vehicle seat **10** is installed via the connection terminals **89**. Thus, the seated person H can be heated simultaneously with the rocking by the movable portion **18**. In addition, since the heater **88** is disposed so as to avoid the movable portion **18**, disconnection due to rocking can be prevented.

(64) Although preferred embodiments of the present invention has been described above, the present invention is not limited to the embodiments, and it goes without saying that various modifications can be adopted without deviating from the essence and gist of the present invention. When rocking is unnecessary, a triangular cushion pad without the drive mechanism **50** may be mounted in the recessed portion **20**, instead of the rocking unit **16**. In this case, such a seat can be used as the vehicle seat **10** without a rocking function.

Claims

1. A vehicle seat, comprising: a seat back configured to support a back of a seated person; a seat cushion configured to support buttocks of the seated person; a frame configured to support the seat cushion and the seat back; and a rocking unit including a drive mechanism fixed to the frame and a movable portion supported by the drive mechanism, the movable portion being configured to abut against the seated person and transmit rocking motion of the drive mechanism to the seated person, wherein: the movable portion includes a sensor configured to acquire biological information of the seated person, wherein the sensor comprises a plurality of sensors, the movable portion includes a wiring network in a matrix shape formed by a plurality of vertical wirings and a plurality of horizontal wirings, and the plurality of sensors is disposed at intersections of the vertical wirings and the horizontal wirings.
2. The vehicle seat according to claim 1, wherein the movable portion is configured to transmit the rocking motion to the seated person based on the biological information of the seated person acquired by the sensor.
3. The vehicle seat according to claim 1, wherein the sensor is disposed on an upper surface of the movable portion.
4. The vehicle seat according to claim 1, wherein the sensor is a strain sensor configured to measure a weight of the seated person.
5. The vehicle seat according to claim 1, wherein the sensor is a strain sensor or a piezoelectric sensor configured to detect vibration caused by heartbeat or respiration of the seated person.
6. The vehicle seat according to claim 1, wherein the sensor is an electric field sensor or a magnetic sensor configured to detect a nerve signal or a myoelectric signal of the seated person.
7. A vehicle seat, comprising: a seat back configured to support a back of a seated person; a seat cushion configured to support buttocks of the seated person; a frame configured to support the seat cushion and the seat back; and a rocking unit including a drive mechanism fixed to the frame and a movable portion supported by the drive mechanism, the movable portion being configured to abut against the seated person and transmit rocking motion of the drive mechanism to the seated person, wherein: the movable portion includes a sensor configured to acquire biological information of the seated person, wherein the movable portion is formed of a substantially triangular cushion pad that

has front edges inclined to approach each other toward a front end in plan view, and the sensor is disposed in an area away from the front end in the triangular cushion pad.

8. A method of producing a vehicle seat, comprising: providing a seat back for supporting a back of a seated person; providing a seat cushion for supporting buttocks of the seated person; providing a frame for supporting the seat cushion and the seat back; and providing a rocking unit including a drive mechanism fixed to the frame and a movable portion supported by the drive mechanism, the movable portion being configured to abut against the seated person and transmit rocking motion of the drive mechanism to the seated person, wherein: the providing the rocking unit comprises disposing, in the movable portion, a sensor configured to acquire biological information of the seated person, the providing the rocking unit comprises forming the movable portion into a substantially triangular cushion pad that has front edges inclined to approach each other toward a front end in plan view, and disposing the sensor in an area away from the front end in the triangular cushion pad.

9. The method according to claim 8, wherein the movable portion is configured to transmit the rocking motion to the seated person based on the biological information of the seated person acquired by the sensor.

10. The vehicle seat according to claim 8, wherein the providing the rocking unit comprises disposing the sensor on an upper surface of the movable portion.

11. The vehicle seat according to claim 8, wherein the sensor is a strain sensor configured to measure a weight of the seated person.

12. The vehicle seat according to claim 8, wherein the sensor is a strain sensor or a piezoelectric sensor configured to detect vibration caused by heartbeat or respiration of the seated person.

13. The vehicle seat according to claim 8, wherein the sensor is an electric field sensor or a magnetic sensor configured to detect a nerve signal or a myoelectric signal of the seated person.

14. The vehicle seat according to claim 8, wherein the sensor comprises a plurality of sensors, the providing the rocking unit comprises: providing, in the movable portion, a wiring network in a matrix shape formed by a plurality of vertical wirings and a plurality of horizontal wirings, and disposing the plurality of sensors at intersections of the vertical wirings and the horizontal wirings.
