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PERCUSSION INSTRUMENT AND MOUNTING METHOD FOR MOUNTING MEMBER

Abstract

A percussion instrument includes a housing, and a lifter provided on an outer circumference side of the housing. The lifter includes a fixed member fixed to a housing side, a mounting member configured to have a variable mounting position in a front-rear direction relative to the fixed member, and a bolt fixing the mounting member to the fixed member. The mounting member includes a mounting portion to which a foot pedal is attached, and fastening portions provided on both sides of the mounting portion in a left-right direction and fastened to the fixed member by a pair of the bolts on left and right sides. A pair of the bolts fasten the fastening portions at positions where respective axial centers do not align.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the priority benefits of Japanese application no. 2024-024556, filed on Feb. 21, 2024. The entirety of the above-mentioned patent application is hereby incorporated by reference herein and made a part of this specification.

BACKGROUND

Technical Field

[0002] The disclosure relates to a percussion instrument and a mounting method for a mounting member, and particularly relates to a percussion instrument and a mounting method for a mounting member that allow easy adjustment of the relative position between a foot pedal and the percussion instrument.

Description of Related Art

[0003] For a percussion instrument whose striking surface is to be hit by a beater of a foot pedal, there is known a technique of adjusting the impact position of the beater on the striking surface by raising the height of the striking surface using a lifter provided on the outer circumference side of a housing. For example, Patent Literature 1 (Japanese Patent Application Laid-Open No. 2014-071196 (for example, paragraphs 0032 to 0040, and FIG. 1 to FIG. 3)) describes a bass drum lifter 20 that includes a pedal connection member 22 (mounting member) to which a pedal device P (foot pedal) is attached, and a drum connection member 23 (fixed member) which is fixed to a bass drum 10 (percussion instrument).

[0004] A long hole 30*a* that extends in the front-rear direction is formed in a retainer 30 of the drum connection member 23, and an insertion hole 36*a* is formed in a base 33 at a position corresponding to the long hole **30***a*. A bolt 40 inserted through these long hole 30*a* and insertion hole 36*a* from below is fastened to a nut plate 35 stacked on top of the base 33.

[0005] In a state where the bolt 40 is loosened, the mounting position of the retainer 30 (pedal connection member 22) relative to the base 33 can be adjusted in the front-rear direction by sliding the long hole 30*a* relative to the bolt 40. In other words, since the relative position between the bass drum 10 and the pedal device P in the front-rear direction can be adjusted, it is possible to prevent the pedal device P from interfering with a striking surface head 15, or to finely adjust the impact position of the beater.

[0006] However, according to the related technology described above, the bolt 40 is fastened from the lower surface side of the retainer 30. Therefore, in order to fasten the bolt 40, it is necessary to insert a hand between the installation surface on which the bass drum 10 is installed and the bass drum lifter 20, or to turn the bass drum 10 upside down. Thus, it has been troublesome for an operation of adjusting the relative position between the pedal device P (foot pedal) and the bass drum 10 (percussion instrument).

[0007] The disclosure provides a percussion instrument and a mounting method for a mounting member that allow easy adjustment of the relative position between the foot pedal and the percussion instrument.

SUMMARY

[0008] A percussion instrument according to the disclosure includes a housing, and a lifter provided on an outer circumference side of the housing. The lifter includes a fixed member fixed to the housing side, a mounting member configured to have a variable mounting position in a front-rear direction relative to the fixed member, and a bolt fixing the mounting member to the fixed member. The mounting member includes a mounting portion to which a foot pedal is attached, and fastening

portions provided on both sides of the mounting portion in a left-right direction and fastened to the fixed member by a pair of the bolts on the left and right sides. A pair of the bolts fasten the fastening portions at positions where respective axial centers do not align.

[0009] A mounting method for a mounting member according to the disclosure is provided for a percussion instrument that includes a housing, and a lifter provided on an outer circumference side of the housing. The lifter includes a fixed member fixed to the housing side, the mounting member configured to have a variable mounting position in a front-rear direction relative to the fixed member, and a bolt fixing the mounting member to the fixed member. The mounting member includes a mounting portion to which a foot pedal is attached, and fastening portions provided on both sides of the mounting portion in a left-right direction and fastened to the fixed member by a pair of the bolts on the left and right sides. The mounting method for the mounting member includes: attaching the mounting member to the fixed member by fastening the fastening portions with a pair of the bolts whose axial centers do not align.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. **1** is a perspective view of the percussion instrument according to the first embodiment.

[0011] FIG. **2** is a perspective view of the percussion instrument, showing a state where the lifter is disassembled.

[0012] FIG. **3** is a partially enlarged front view of the percussion instrument, as viewed in the direction of arrow III in FIG. **1**.

[0013] FIG. **4** is a partially enlarged cross-sectional view of the percussion instrument, taken along line IV-IV in FIG. **3**.

[0014] FIG. **5** is an exploded perspective view of the attachment.

[0015] FIG. **6** is an exploded perspective view of the percussion instrument.

[0016] FIG. **7** is a partially enlarged cross-sectional view of the percussion instrument.

[0017] FIG. **8** is a partially enlarged cross-sectional view of the percussion instrument, showing a state where the striking surface of the attachment is hit by the beater from the state in FIG. **4**.

[0018] FIG. **9**A is a partially enlarged front view of the percussion instrument according to the second embodiment, and FIG. **9**B is a partially enlarged front view of the percussion instrument according to the third embodiment.

[0019] FIG. **10** is an exploded perspective view of the percussion instrument according to the fourth embodiment.

[0020] FIG. **11** is a partially enlarged cross-sectional view of the percussion instrument.

DESCRIPTION OF THE EMBODIMENTS

[0021] Exemplary embodiments will be described hereinafter with reference to the attached drawings. First, the overall configuration of a percussion instrument **1** according to the first embodiment will be described with reference to FIG. **1**. FIG. **1** is a perspective view of the percussion instrument **1** according to the first embodiment.

[0022] In the following description, the side of the percussion instrument **1** closer to the performer when viewed from the performer's side is referred to as the front (front side) of the percussion instrument **1**, and the opposite side is referred to as the rear of the percussion instrument **1**. Additionally, the left side when viewed from the performer's side is referred to as the left side of the percussion instrument **1**, and the opposite side is referred to as the right side of the percussion instrument **1**.

[0023] As shown in FIG. **1**, the percussion instrument **1** is a bass drum in which an opening portion at the front end (axial end portion) of a cylindrical shell **2** is closed with a head **3**. A rod-shaped stand **4** that inclines downward toward the rear side of the shell **2** is attached to the outer

circumferential surface of the shell **2** (body portion). The stand **4** is provided in a pair on the side surface on both the left and right sides of the shell **2**, and this pair of stands **4** support the rear end portion of the shell **2** on the installation surface.

[0024] The head **3** is formed into a disc shape using a synthetic resin film and is attached to the shell **2** by a ring-shaped hoop **5**. C-shaped (U-shaped) mounting fittings **6** are hooked on the hoop **5** at multiple locations in the circumferential direction. Through holes (not shown) are formed in the portions of the mounting fittings **6** that are positioned on the outer circumference side of the hoop **5**, and tension bolts **7** are inserted into these through holes. Multiple lugs **8** arranged in the circumferential direction are provided on the outer circumferential surface of the shell **2**. By screwing the tension bolts **7** into the lugs **8** while hooking the outer edge of the head **3** on the hoop **5**, tension is applied to the head **3**.

[0025] An attachment **10** is fixed to the head **3** by multiple fasteners **9**. The detailed configuration of this fixing structure using the fasteners **9** and the attachment **10** will be described later, but the attachment **10** is fitted into a circular through hole **3***a* formed in the head **3**, and this attachment **10** is to be hit by a foot pedal **100**.

[0026] The foot pedal **100** includes a base plate **101** that is installed on the installation surface, and a foot board **102** is pivotally supported at the base end portion (end portion on the performer's side) of this base plate **101**. When the performer steps on the foot board **102**, a beater **103** rotates to hit (performance of the percussion instrument **1**) the attachment **10**. A clamp **104** is provided on the tip side of the base plate **101**, and when the performer performs with the percussion instrument **1**, this clamp **104** is attached to a lifter **20** of the percussion instrument **1**.

[0027] Next, the detailed configuration of the lifter **20** will be described with reference to FIG. **1** and FIG. **2**. FIG. **2** is a perspective view of the percussion instrument **1**, showing a state where the lifter **20** is disassembled.

[0028] As shown in FIG. **1** and FIG. **2**, the lifter **20** includes a fixed member **21** fixed to the shell **2**, and a mounting member **22** attached to the fixed member **21**. Each of the fixed member **21** and the mounting member **22** (lifter **20**) has a left-right symmetrical shape.

[0029] The fixed member **21** includes a pair of fixed portions **21***a* (see FIG. **2**) spaced apart on the left and right (in the circumferential direction of the outer circumferential surface of the shell **2**). The fixed portion **21***a* is formed into a rectangular flat plate shape, and a through hole **21***a***1** is formed in the center of the fixed portion **21***a*. A bolt **23** inserted into the through hole **21***a***1** is fastened to the shell **2**, thereby attaching the fixed member **21** (a pair of fixed portions **21***a*) to the shell **2**. Although not shown in the figure, a resin spacer is sandwiched between the fixed portion **21***a* and the outer circumferential surface of the shell **2**.

[0030] A hanging portion **21***b* hangs downward from the front end side (end portion on the performer's side) of the pair of fixed portions **21***a*, and bent portions **21***c* are bent toward the front side from both the left and right ends of the hanging portion **21***b*. A female threaded hole **21***c***1** is formed on the front end side (front side with respect to the center in the front-rear direction) of the bent portion **21***c*, and the mounting member **22** is attached to the fixed member **21** by a bolt **24** that is fastened to the female threaded hole **21***c***1** (see FIG. **1** for this mounting state).

[0031] The mounting member **22** includes a mounting portion **22***a* extending in the horizontal direction, and a pair of fastening portions **22***b* bent upward from both the left and right ends of the mounting portion **22***a*. A long hole **22***b***1** (see FIG. **2**) extending in the front-rear direction is formed in the fastening portion **22***b*, and the mounting member **22** is fixed to the fixed member **21** by fastening the bolt **24** inserted into the long hole **22***b***1** to the female threaded hole **21***c***1** of the fixed member **21**. On the other hand, by sliding the fastening portion **22***b* (mounting member **22**) along the long hole **22***b***1** while the bolt **24** is loosened, the fastening position of the fastening portion **22***b* relative to the bent portion **21***c* can be adjusted in the front-rear direction.

[0032] Next, a case where the foot pedal **100** is attached to the lifter **20** will be described with reference to FIG. **3** and FIG. **4**. FIG. **3** is a partially enlarged front view of the percussion

instrument **1**, as viewed in the direction of arrow III in FIG. **1**, and FIG. **4** is a partially enlarged cross-sectional view of the percussion instrument **1**, taken along line IV-IV in FIG. **3**.
[0033] Additionally, in FIG. **3**, the shape of the clamp **104** of the foot pedal **100** that grasps the mounting member **22** (mounting portion **22***a*) is schematically illustrated and shown with hatching. Moreover, in FIG. **4**, the illustration of the mounting fittings **6** (see FIG. **3**) of the hoop **5** is omitted.
[0034] As shown in FIG. **3** and FIG. **4**, in the case where the foot pedal **100** is attached to the percussion instrument **1**, the mounting portion **22***a* is sandwiched from above and below by the clamp **104**. In the state where the foot pedal **100** is attached to the mounting portion **22***a*, the front end portion of the percussion instrument **1** is supported on the installation surface G such as the floor via the foot pedal **100**. As mentioned above, the rear end side of the percussion instrument **1** is supported on the installation surface G by the stands **4** (see FIG. **1**).
[0035] When attaching the foot pedal **100** to the mounting portion **22***a*, the foot pedal **100** may interfere with the percussion instrument **1** (head **3** or hoop **5**), or the impact position of the beater **103** (see FIG. **4**) may not be appropriate. In such cases, an operation is performed to adjust the relative position between the percussion instrument **1** and the foot pedal **100** in the front-rear direction by loosening the bolt **24** and sliding the fastening portion **22***b* back and forth relative to the bent portion **21***c*.
[0036] As the related technology for this type of percussion instrument **1**, there is known a technique of fastening the bolt from the lower surface side of the mounting member (for example, drum connection member 23 in Japanese Patent Application Laid-Open No. 2014-071196) to which the foot pedal is attached. However, according to this related technology, it is necessary to insert a hand (or tool) into the narrow space between the installation surface and the lifter, or to turn the percussion instrument upside down when performing the fastening operation of the bolt. Therefore, adjusting the relative position between the percussion instrument and the foot pedal requires considerable effort.
[0037] In contrast, according to this embodiment, the fastening portions **22***b* are provided on both sides in the left-right direction of the mounting portion **22***a* to which the foot pedal **100** is attached, and these fastening portions **22***b* are fastened to the fixed member **21** (bent portions **21***c*) by the bolts **24**. As a result, even when the percussion instrument **1** is installed on the installation surface G, the fastening operation of the bolt **24** can be performed utilizing the relatively wide space S (see FIG. **3**) formed on both the left and right sides (lateral sides of the lifter **20**) of the mounting portion **22***a*. In other words, the relative position between the percussion instrument **1** and the foot pedal **100** can be easily adjusted without turning the percussion instrument **1** upside down.
[0038] In a state where the fixed member **21** and the mounting member **22** are fastened by the bolts **24**, the side surface of the bent portion **21***c* facing the outer side in the left-right direction comes into contact with the side surface of the fastening portion **22***b* facing the inner side in the left-right direction. Hereinafter, these respective side surfaces are referred to as “fastening surfaces”, and the fastening surfaces of the bent portion **21***c* and the fastening portion **22***b* on the left side of the lifter **20**, together with the fastening surfaces of the bent portion **21***c* and the fastening portion **22***b* on the right side, are collectively referred to and described as “left and right fastening surfaces” and so on.
[0039] In this embodiment, the left and right fastening surfaces are inclined with respect to the vertical direction. However, for example, even if the left and right fastening surfaces are planes along the vertical direction, it is possible to perform the fastening operation of the bolt **24** by utilizing the wide space S (see FIG. **3**) on both sides of the lifter **20**.
[0040] However, if the left and right fastening surfaces of the lifter **20** are configured as planes along the vertical direction (with the left and right fastening surfaces facing each other in parallel), the axial centers of the left and right bolts **24** align (line up in a straight line), which may cause the mounting member **22** to rotate around the bolts **24** due to vibration generated when the foot pedal **100** is stepped on.
[0041] When the mounting member **22** rotates around the bolts **24** as an axis, the relative position

between the percussion instrument **1** and the foot pedal **100** may shift during performance, which degrades the playability of the percussion instrument **1**. Additionally, when the mounting member **22** rotates around the bolts **24** as an axis, the bolts **24** may loosen, making it easier for rattling to occur between the mounting member **22** and the fixed member **21**. This also leads to a decrease in the playability of the percussion instrument **1**.

[0042] In order to suppress such rotation of the mounting member **22**, it is also considered to fasten each of the left and right fastening surfaces with two bolts **24** (providing a total of four bolts **24** on the left and right fastening surfaces). However, in a configuration where multiple bolts **24** are provided on the left and right fastening surfaces, the fastening operation of the bolt **24** requires considerable effort, and the lifter **20** becomes larger in size.

[0043] In contrast, according to this embodiment, the left and right fastening surfaces of the lifter **20** are non-parallel to the vertical direction, and the left and right bolts **24** fasten the fastening portions **22***b* at positions where the respective axial centers do not align. In other words, the axial centers of the bolts **24**, each provided on the left and right fastening surfaces, do not line up in a straight line.

[0044] Thus, the rotation of the mounting member **22** relative to the fixed member **21** (rotation of the mounting member **22** around the bolts **24** as an axis) can be regulated by the engagement between the bolts **24** and the fastening portions **22***b*, or by the engagement between the left and right fastening surfaces (bent portion **21***c* and fastening portion **22***b*). Therefore, it is possible to suppress the relative position between the percussion instrument **1** and the foot pedal **100** from shifting during performance, thus improving the playability of the percussion instrument **1**. Additionally, since the mounting member **22** does not rotate around the bolts **24** as an axis, it is possible to suppress the loosening of the bolts **24** due to such rotation. As it becomes difficult for rattling to occur between the fixed member **21** (bent portion **21***c*) and the mounting member **22**, the playability of the percussion instrument **1** can be improved.

[0045] Here, a percussion instrument **201** of the second embodiment and a percussion instrument **301** of the third embodiment (see FIG. **9**A and FIG. **9**B), which will be described later, are illustrated as other examples of the configuration that can facilitate the fastening operation of the bolt **24**. Details will be described later, but in the percussion instrument **201** of the second embodiment (see FIG. **9**A), the fastening operation of the bolt **24** is performed utilizing the space S between the hoop **5** and the bent portion **221***c*, and in the percussion instrument **301** of the third embodiment (see FIG. **9**B), the fastening operation of the bolt **24** is performed utilizing the space S between the fastening portion **322***b* and the installation surface G.

[0046] However, in the configuration where the bolt **24** is fastened in the up-down direction, as in the percussion instrument **201** of the second embodiment and the percussion instrument **301** of the third embodiment, the hoop **5** and the installation surface G may interfere with the hand or tool performing the fastening operation of the bolt **24**.

[0047] In contrast, according to this embodiment, the left and right fastening surfaces (fastening portions **22***b*) of the lifter **20** incline upward from the mounting portion **22***a* toward the outer side in the left-right direction (see FIG. **3**), making it possible to fasten the bolt **24** from the lateral side of the fastening portion **22***b*. Thus, compared to the percussion instrument **201** of the second embodiment and the percussion instrument **301** of the third embodiment, the hoop **5** and the installation surface G are less likely to interfere with the hand or tool performing the fastening operation of the bolt **24**. Therefore, the workability of the fastening operation of the bolt **24** can be improved.

[0048] Furthermore, the axial center of the bolt **24** is positioned above the vertical center C**1** of the left and right fastening surfaces. That is, since the bolt **24** fastens the fixed member **21** (bent portion **21***c*) and the fastening portion **22***b* above the vertical center C**1** of the fastening surface, compared to the case where the bolt **24** is provided below the vertical center C**1** of the fastening surface, for example, it becomes less likely for the installation surface to interfere with the hand or

tool performing the fastening operation of the bolt **24**. This can also improve the workability of the fastening operation of the bolt **24**.

[0049] In addition, according to this embodiment, the inclination angle of the left and right fastening surfaces (bent portion **21***c* and fastening portion **22***b*) with respect to the vertical direction is 25°, but this inclination angle of the fastening surface is preferably 5° or more and 40° or less. Within this angle range, interference of the percussion instrument 1 or the installation surface with the hand or tool performing the fastening operation of the bolt **24** can be suppressed. Furthermore, the inclination angle of the left and right fastening surfaces is more preferably 15° or more and 30° or less, and within this angle range, interference of the percussion instrument **1** or the installation surface with the hand or tool performing the fastening operation of the bolt **24** can be suppressed more effectively.

[0050] After fastening the fixed member **21** and the mounting member **22** with the bolt **24**, the percussion instrument **1** is played by stepping on the foot pedal **100**. During this performance, a vertical load (vibration) is likely to act on the mounting portion **22***a* to which the foot pedal **100** is attached. When a load during performance repeatedly acts on the mounting portion **22***a*, the bolt **24** may loosen.

[0051] That is, as mentioned above, the lifter **20** of this embodiment is configured to generally prevent the rotation of the mounting member **22** around the bolt **24** as an axis. However, when a load during performance repeatedly acts on the mounting portion **22***a* (mounting member **22**), the bolt **24** may gradually loosen.

[0052] In contrast, according to this embodiment, the bent portion **21***c* (fixed member **21**) is fastened to the inner side in the left-right direction of the fastening portion **22***b*, so that even if the bolt **24** loosens or falls off, the bent portion **21***c* (fixed member **21**) can be retained inside the left and right fastening portions **22***b*. In other words, even if the bolt **24** falls off during performance, the mounting member **22** can maintain the state of supporting the fixed member **21** from below, so that the performance of the percussion instrument **1** can be continued.

[0053] Also, since a load during performance is likely to act on the mounting portion **22***a*, in this embodiment, a reinforcing portion **22***c* is stacked (joined) on the lower surface of the mounting portion **22***a* to ensure the rigidity of the mounting portion **22***a*. The mounting portion **22***a* and the reinforcing portion **22***c* are integrally formed by bending a single metal plate (as shown in FIG. **4**, folding back the reinforcing portion **22***c* from the rear end portion of the mounting portion **22***a* to the lower surface side of the mounting portion **22***a*). Similarly, the mounting portion **22***a* and the fastening portion **22***b* are also integrally formed by bending a metal plate, so that the mounting member **22** having these portions **22***a* to **22***c* can be easily formed from a single metal plate.

[0054] A load during performance also acts on the fixed member **21** via the mounting member **22**. In this case, as in the percussion instrument **201** of the second embodiment and the percussion instrument **301** of the third embodiment (see FIG. **9**A and FIG. **9**B), which will be described later, with the structure where the bent portions **221***c* and **321***c* are bent from the lower end portion or upper end portion of the hanging portions **221***b* and **321***b*, the load when the foot pedal **100** is stepped on acts in the plate thickness direction of the bent portions **221***c* and **321***c*. Therefore, bending is likely to occur in the bent portions **221***c* and **321***c*, or deformation is likely to occur in the bent portion between the hanging portions **221***b* and **321***b* and the bent portions **221***c* and **321***c*.

[0055] In other words, in the configurations of the second and third embodiments to be described later, the rigidity of the fixed members **221** and **321** against the load acting from the foot pedal **100** decreases, making it easier for the relative position between the percussion instrument **1** and the foot pedal **100** to shift during performance.

[0056] In contrast, according to this embodiment, the fastening portion **22***b* is fastened to the bent portion **21***c* that is bent toward the front side from both the left and right ends of the hanging portion **21***b* (the plate surface of the bent portion **21***c* is directed to the left and right), making it possible to suppress the vertical load during performance from acting in the plate thickness

direction of the bent portion **21***c* (the bending direction of the bent portion **21***c* with respect to the hanging portion **21***b*). This can suppress the occurrence of bending in the bent portion **21***c* or deformation in the bent portion between the hanging portion **21***b* and the bent portion **21***c*. In other words, the rigidity of the fixed member **21** against the load acting from the foot pedal **100** can be improved, making it difficult for the relative position between the percussion instrument **1** and the foot pedal **100** to change during performance. Therefore, the playability of the percussion instrument **1** can be improved.

[0057] Moreover, since the fixed portion **21***a*, the hanging portion **21***b*, and the bent portion **21***c* constituting the fixed member **21** are integrally formed by bending a metal plate, the fixed member **21** can be easily formed from a single metal plate.

[0058] Next, the configuration of the attachment **10** to be hit by the beater **103** (see FIG. **4**) during performance of the percussion instrument **1** will be described with reference to FIG. **5**. FIG. **5** is an exploded perspective view of the attachment **10**.

[0059] As shown in FIG. **5**, the attachment **10** includes a disc-shaped membrane member **11** whose front surface serves as a striking surface **11***a*. A cushion **12** for absorbing impact of the hit on the striking surface **11***a* is adhered to the rear surface of the membrane member **11**.

[0060] The membrane member **11** is formed into a membrane shape using a mesh-like material (mesh) woven from synthetic fibers, but the material of the membrane member **11** may be any material that is harder (has higher hardness) than the cushion **12**. Therefore, for example, the membrane member **11** may also be formed using a synthetic resin film. The cushion **12** is formed into a disc shape thicker than the membrane member **11**, and the diameters of the membrane member **11** and the cushion **12** are the same. That is, the outer shapes (shapes when viewed in the front-rear direction) of the membrane member **11** and the cushion **12** are the same.

[0061] The cushion **12** is formed using a foamed synthetic resin such as polyurethane foam. However, as long as the cushion **12** has a predetermined flexibility, the cushion **12** may be formed using rubber, resins such as elastomer (synthetic resin), or foam materials using these resins (hereinafter referred to as “elastic materials”).

[0062] The rear surface of the cushion **12** is supported by a support membrane **13**. The support membrane **13** is formed into a disc shape using a mesh woven from synthetic fibers or a synthetic resin film, and a ring-shaped frame **14** is fixed to the outer edge of the support membrane **13**. The frame **14** is formed using a resin material, and the support membrane **13** and the frame **14** are integrally formed by mold forming. Alternatively, the frame **14** may be formed using a material other than resins (for example, metals such as aluminum and iron), and joined to the support membrane **13** by adhesion or the like.

[0063] Multiple press-fit holes **14***a* (in this embodiment, at six locations) are formed at equal intervals in the circumferential direction on the outer edge of the frame **14**. These press-fit holes **14***a* are holes into which the fasteners **9** (see FIG. **6**), which will be described later, are fitted.

[0064] A disc-shaped cushion **15** formed using an elastic material is stacked on the rear surface of the support membrane **13**, and a mounting plate **16** is stacked on the rear surface of the cushion **15**. The mounting plate **16** is formed into a disc shape using a resin or metal material, and a disc-shaped sensor **17** (piezoelectric element) is attached to the center of the mounting plate **16** by a cushioning double-sided tape.

[0065] Multiple press-fit holes **16***a* are formed on the outer edge of the mounting plate **16** at positions corresponding to the press-fit holes **14***a* of the frame **14**. The attachment **10** is attached to the head **3** by the fasteners **9** (see FIG. **6**) that are press-fitted into these press-fit holes **14***a* and **16***a*.

[0066] The mounting structure of this attachment **10** will be described with reference to FIG. **6** and FIG. **7**. FIG. **6** is an exploded perspective view of the percussion instrument **1**, and FIG. **7** is a partially enlarged cross-sectional view of the percussion instrument **1**. It should be noted that FIG. **7** illustrates a cross-section cut through a plane including the axis of the fastener **9**.

[0067] As shown in FIG. **6**, the head **3** of the percussion instrument **1** is attached to the shell **2** by

the hoop **5** and the mounting fittings **6** as described above, and a through hole **3***a* is formed in the head **3** for fitting the membrane member **11** and the cushion **12** of the attachment **10**.

[0068] Around the through hole **3***a*, multiple (in this embodiment, **6**) press-fit holes **3***b* are formed at equal intervals in the circumferential direction, and the fasteners **9** are press-fitted into the press-fit holes **3***b*. The fasteners **9** are pins made of elastomer or rubber.

[0069] In addition, multiple (in this embodiment, **6** pieces) resin plates **30** are joined to the rear surface of the head **3** to reinforce the area surrounding the through hole **3***a*. The multiple plates **30** are formed by equally dividing a ring-shaped film in the circumferential direction. That is, each of the multiple plates **30** is formed into a fan shape, and the through hole **3***a* is surrounded entirely by these multiple fan-shaped plates **30**. The plate **30** is formed with a press-fit hole **30***a* for press-fitting the fastener **9**.

[0070] As shown in FIG. **7**, the fastener **9** includes a disc-shaped head portion **9***a* and a shaft portion **9***b* protruding in the thickness direction (rear side) of the head portion **9***a*. The diameter of the head portion **9***a* is formed larger than the diameter of the press-fit hole **3***b* of the head **3**.

[0071] The shaft portion **9***b* is formed with a protrusion **9***c* for hooking the head **3** and the plate **30**, and a groove **9***d* for hooking the press-fit hole **14***a* of the frame **14** and the press-fit hole **16***a* of the mounting plate **16**. The protrusion **9***c* is an annular protrusion that extends in the circumferential direction of the shaft portion **9***b*. A gap corresponding to the membrane thickness of the head **3** and the plate **30** is formed between the head portion **9***a* and the protrusion **9***c*, and the outer diameter of the protrusion **9***c* is formed slightly larger than the diameter of the press-fit hole **3***b* of the head **3** and the press-fit hole **30***a* of the plate **30**. Therefore, by press-fitting the protrusion **9***c* into the press-fit holes **3***b* and **30***a*, the head **3** and the plate **30** are hooked between the head portion **9***a* and the protrusion **9***c*.

[0072] The groove **9***d* is an annular recess that extends in the circumferential direction of the shaft portion **9***b*, and in the region where the groove **9***d* is formed, the diameter of the shaft portion **9***b* is formed to be the same as the inner diameter of the press-fit hole **14***a* of the frame **14** and the press-fit hole **16***a* of the mounting plate **16**. Therefore, by press-fitting the shaft portion **9***b* into the press-fit holes **14***a* and **16***a*, the frame **14** and the mounting plate **16** are hooked into the groove **9***d*. As a result, the attachment **10** is attached to the rear surface of the head **3** by the fasteners **9**.

[0073] In the mounting state of this attachment **10**, the support membrane **13**, the frame **14**, the cushion **15**, and the mounting plate **16** constitute a support body that supports the membrane member **11** and the cushion **12** on the rear surface side of the head **3**. Then, the membrane member **11** and the cushion **12** interposed between this support body and the head **3** are pressed against the peripheral part of the through holes **3***a* of the head **3** via the plates **30**, which achieves a configuration that can improve the durability of the membrane member **11** and the cushion **12**.

[0074] The detailed configuration of this attachment **10** will be described with reference to FIG. **8**. FIG. **8** is a partially enlarged cross-sectional view of the percussion instrument **1**, showing a state where the striking surface **11***a* of the attachment **10** is hit by the beater **103** from the state in FIG. **4**.

[0075] As shown in FIG. **8**, the membrane member **11** (striking surface **11***a*) of the attachment **10** is hit by the beater **103** of the foot pedal **100**, and the impact at the time of hitting is absorbed by the cushion **12**. Therefore, the striking sound generated at the time of hitting the membrane member **11** can be reduced.

[0076] In the related technology for this type of percussion instrument **1** (for example, International Publication No. 2017/038226), in the case where the membrane member **11** is hit, a deformation occurs in which the outer edge portion of the cushion **12** expands (the thickness increases), resulting in problems such as peeling occurring at the adhesion portion between the membrane member **11** and the cushion **12**, or cracks forming on the outer circumferential surface of the cushion **12**.

[0077] In contrast, according to this embodiment, the outer edge portion of the membrane member **11** and the cushion **12** is arranged to overlap with the peripheral part of the through holes **3***a* of the

head **3** in the front-rear direction (the striking surface **11***a* is formed by the portion of the membrane member **11** positioned on the inner circumference side of the through holes **3***a* of the head **3**). Thus, in the case where the membrane member **11** is hit by the beater **103**, the expansion deformation of the outer edge of the cushion **12** can be regulated by the head **3**. Therefore, it is possible to suppress the occurrence of peeling at the adhesion portion between the membrane member **11** and the cushion **12**, or the occurrence of cracks on the outer circumferential surface of the cushion **12**. Consequently, the durability of the striking surface **11***a* (the hit body composed of the membrane member **11** and the cushion **12**) can be improved.

[0078] Furthermore, in the state where the attachment **10** is attached to the head **3**, the gap between the head **3** (plate **30**) and the support membrane **13** is formed to be smaller than the thickness of the membrane member **11** and the cushion **12**. Therefore, in a state before the striking surface **11***a* is hit, the outer edge portion of the cushion **12** is compressed by the head **3**. As a result, the expansion deformation of the outer edge portion of the cushion **12** can be effectively suppressed, thereby improving the durability of the membrane member **11** and the cushion **12**.

[0079] Moreover, since the outer edge portion of the cushion **12** is compressed by the head **3**, in addition to the function of attaching the attachment **10**, the head **3** can also have the function of regulating the expansion of the outer edge of the cushion **12**.

[0080] In addition, multiple plates **30** that are harder (higher hardness) than the head **3** (membrane member **11**) are sandwiched between the head **3** and the membrane member **11**. These multiple plates **30** are arranged in a ring shape around the through hole **3***a*, so the expansion deformation of the outer edge of the cushion **12** can be uniformly regulated over the entire circumference of the cushion **12**. Therefore, the durability of the membrane member **11** and the cushion **12** can be improved. Furthermore, the compression amount of the cushion **12** can be adjusted by changing the thickness of the plate **30**.

[0081] Furthermore, since multiple plates **30** are attached around the through hole **3***a* of the head **3**, the rigidity of the head **3** can be enhanced by the plates **30**. As a result, damage to the head **3** that presses down on the membrane member **11** and the cushion **12** can be suppressed, and the expansion deformation of the outer edge of the cushion **12** can be effectively regulated by the head **3** and the plates **30**. Therefore, the durability of the head **3**, the membrane member **11**, and the cushion **12** can be improved.

[0082] Thus, in the case of aiming to enhance the rigidity around the through hole **3***a* with the plates **30**, it is also possible to, for example, integrally form multiple plates **30** and attach a single ring-shaped plate **30** around the through hole **3***a* of the head **3**. However, with such a configuration, it becomes easier for the plate **30** to bend, making it difficult to properly attach the plate **30** to the head **3**.

[0083] Also, in a configuration where a single ring-shaped plate **30** is cut out from a resin plate used as the material, the number of plates **30** that can be cut out from the resin plate decreases (all the resin plate cut off on the inner circumference side of the ring-shaped plate **30** becomes waste material). Therefore, the manufacturing cost of the plate **30** increases.

[0084] In contrast, according to this embodiment, multiple (annular fan-shaped) plates **30** are arranged in a ring shape around the through hole **3***a*. Thus, compared to the case where a single plate **30** is formed into a ring shape as described above, the bending of the plates **30** can be suppressed, allowing the plates **30** to be appropriately attached to the head **3**. Therefore, the workability of the attaching operation for the plates **30** can be improved.

[0085] Furthermore, when cutting out multiple (annular fan-shaped) plates **30** from the resin plate used as the material, it is possible to cut out a larger number of plates **30** from the resin plate (thereby reducing the amount of waste resin plate), compared to the case of cutting out a single ring-shaped plate **30** as described above. Therefore, the manufacturing cost of the plates **30** can be reduced.

[0086] When the membrane member **11** (striking surface **11***a*) is hit, the vibration is detected by the

sensor **17** attached to the mounting plate **16**, and a musical sound signal based on the detection result is generated by a sound source (not shown). The musical sound signal generated by the sound source is output to an amplifier and a speaker (both not shown), thereby emitting an electronic musical sound from the speaker.

[0087] Thus, when detecting a hit on the striking surface **11***a* with the sensor **17**, the related technology mentioned above (for example, International Publication No. 2017/038226) has the following problem for there is no member compressing the outer edge of the cushion **12** as in this embodiment.

[0088] In other words, in a configuration where the outer edge of the cushion **12** is not compressed, deformation is more likely to occur (impact absorption capacity increases) on the outer edge side of the cushion **12** than near the center of the cushion **12**. Therefore, in the case where the outer circumference side of the striking surface **11***a* (membrane member **11**) is hit, the output value of the sensor **17** tends to be smaller compared to the case where the central area of the striking surface **11***a* is hit. That is, the sensitivity distribution of the sensor **17** to hits on the striking surface **11***a* becomes non-uniform.

[0089] If the sensitivity distribution of the sensor **17** is non-uniform, when the performer hits the striking surface **11***a* with a twin pedal type foot pedal **100**, different musical sounds (for example, sounds with different volumes) are more likely to be generated at the time of impact by the left and right beaters **103**. In order to eliminate such a malfunction in musical sound generation, it is necessary to finely adjust the mounting position of the foot pedal **100** to the left or right relative to the percussion instrument **1** so that the center (sensor **17**) of the striking surface **11***a* is positioned between the left and right beaters **103**. Therefore, there is a problem that the mounting operation of the foot pedal **100** requires considerable effort.

[0090] In contrast, according to this embodiment, the outer edge of the cushion **12** is compressed, making it difficult for differences in ease of deformation (impact absorption capacity) to occur between the central area and the outer edge side of the cushion **12**. As a result, the sensitivity distribution of the sensor **17** to hits on the striking surface **11***a* (membrane member **11**) can be made uniform. Therefore, for example, when using a twin pedal type foot pedal **100**, it is easy to generate an appropriate musical sound even if the mounting position of the foot pedal **100** (impact positions of the left and right beaters **103**) is shifted to the left or right relative to the center of the striking surface **11***a*. In other words, there is no need to finely adjust the mounting position of the foot pedal **100** to the left or right relative to the percussion instrument **1**, which makes the mounting operation of the foot pedal **100** easier.

[0091] Thus, in the case of detecting a hit on the membrane member **11** using the sensor **17** attached to the mounting plate **16**, it is also possible to omit the cushion **15**, for example. That is to say, the attachment **10** of this embodiment includes a membrane-like support membrane **13** stacked on the rear surface side of the cushion **12**, and a frame **14** connected to the outer edge of this support membrane **13**, with the mounting plate **16** attached to this frame **14**. Therefore, even if the cushion **15** is omitted, for example, the vibration generated when the membrane member **11** is hit can be transmitted to the sensor **17** via the cushion **12**, the support membrane **13**, the frame **14**, and the mounting plate **16**.

[0092] However, if the cushion **15** is omitted, when the vibration transmitted from the frame **14** causes the mounting plate **16** itself to vibrate, it is not possible to quickly attenuate the vibration of the mounting plate **16**. In the case where the attenuation of the vibration of the mounting plate **16** is slow, the vibration may be erroneously detected by the sensor **17**, and therefore, the sensor **17** cannot accurately detect a hit on the membrane member **11**.

[0093] In contrast, according to this embodiment, the cushion **15** is provided to be sandwiched between the support membrane **13** and the mounting plate **16**, so the vibration of the mounting plate **16** can be attenuated quickly by the cushion **15**. As a result, the sensor **17** can detect a hit on the membrane member **11** with high accuracy.

[0094] While the cushion **15** is required to have the function of absorbing the vibration of the mounting plate **16**, the cushion **12** also needs to have the function of absorbing the impact of a hit on the membrane member **11**, as well as the function of providing a striking feel (similar to the striking feel of an acoustic drum) at the time of hitting the membrane member **11**. Therefore, in this embodiment, the cushion **12** is formed using a foam material with a higher density (higher hardness) than the cushion **15**. In this way, the cushion **12** can absorb the impact of a hit on the membrane member **11** while improving the striking feel at the time of hitting the membrane member **11**.

[0095] On the other hand, since the striking feel at the time of hitting the membrane member **11** can be generally ensured by the cushion **12** and the support membrane **13**, the cushion **15** is not required for the function of providing a striking feel, but mainly for the function of attenuating the vibration of the mounting plate **16**. Thus, forming the cushion **15** from a low-density foam material can reduce the cost (and weight) of the cushion **15** while providing the necessary function (attenuating the vibration of the mounting plate **16**) to the cushion **15**.

[0096] Additionally, since the sensor **17** is sandwiched between the cushion **15** and the mounting plate **16**, the sensitivity of the sensor **17** to a hit on the membrane member **11** can be improved (the maximum value of the output value of the sensor **17** can be increased) compared to the case where the sensor **17** is attached to the rear surface of the mounting plate **16**. The reason is considered to be that part of the vibration from the hit on the membrane member **11** is transmitted to the sensor **17** via the cushion **12**, the support membrane **13**, and the cushion **15**. As a result, the hit on the membrane member **11** can be accurately detected by the sensor **17**.

[0097] Here, the hit from the beater **103** is often in a direction inclined downward toward the rear lower side of the percussion instrument **1** (direction toward the lower left in FIG. **8**), and when the membrane member **11** is hit in such a direction, the membrane member **11** and the cushion **12** are pushed (pulled) downward. Therefore, if the overlap margin La of the upper end side of the membrane member **11** with the head **3** is small, the outer edge of the membrane member **11** and the cushion **12** may be easily exposed (easily protrude) to the inner circumference side of the through hole **3***a* of the head **3** at the time of being hit by the beater **103**.

[0098] In contrast, according to this embodiment, the configuration can suppress such exposure of the membrane member **11** and the cushion **12**. This configuration will be described with reference back to FIG. **5**. It should be noted that in FIG. **5**, a circle corresponding to the through hole **3***a* of the head **3** is illustrated with a two-dot chain line.

[0099] As shown in FIG. **5**, the radial dimension of the membrane member **11** and the cushion **12** based on the center C**2** of the through hole **3***a* is formed to be largest in the region R on the upper end side of the membrane member **11** and the cushion **12**. In other words, the overlap margin La between the head **3** and the membrane member **11** (cushion **12**) in the region R including the upper edge of the membrane member **11** is formed to be larger than the overlap margin Lb in other regions. These overlap margins La and Lb indicate the range where the peripheral part of the through hole **3***a* of the head **3** overlaps with the membrane member **11** and the cushion **12** when viewed in the front-rear direction (when viewed in the thickness direction of the membrane member **11**).

[0100] By increasing the overlap margin La with the head **3** in the region R including the upper edge of the membrane member **11** (cushion **12**) in this way, the exposure (protrusion) of the outer edge of the membrane member **11** and the cushion **12** to the inner circumference side of the through hole **3***a* can be suppressed even when the membrane member **11** and the cushion **12** are pushed downward by the hit of the beater **103** (see FIG. **8**). As such exposure of the membrane member **11** and the cushion **12** is suppressed, interference with the performance of the percussion instrument **1** can be prevented (for example, the operation of reattaching the attachment **10** to the head **3** can be unnecessary).

[0101] It should be noted that the dimension of the overlap margin La between the head **3** and the

membrane member **11** (cushion **12**), and the range in the circumferential direction of the region R where the overlap margin La is relatively large should be appropriately set to the extent that the membrane member **11** or the cushion **12** is not exposed to the inner circumference side of the through hole **3***a* when hit by the beater **103**.

[0102] Next, the percussion instrument **201** of the second embodiment and the percussion instrument **301** of the third embodiment will be described with reference to FIG. **9**A and FIG. **9**B. The first embodiment described above illustrates a case where the bent portions **21***c* are formed on both the left and right end sides of the hanging portion **21***b* of the lifter **20**. However, the second and third embodiments illustrate cases where bent portions **221***c* and **321***c* are respectively formed on both the upper and lower end sides of the hanging portions **221***b* and **321***b*. It should be noted that the same reference numerals are assigned to the same parts as in the first embodiment described above, and descriptions thereof will be omitted.

[0103] FIG. **9**A is a partially enlarged front view of the percussion instrument **201** according to the second embodiment, and FIG. **9**B is a partially enlarged front view of the percussion instrument **301** according to the third embodiment.

[0104] As shown in FIG. **9**A, the lifter **220** of the percussion instrument **201** of the second embodiment includes a fixed member **221** that is fixed to the shell **2** (see FIG. **1**), and a mounting member **222** that is attached to the fixed member **221**. Each of the fixed member **221** and the mounting member **222** (lifter **220**) has a left-right symmetrical shape.

[0105] The hanging portion **221***b* of the fixed member **221** has the same configuration as the hanging portion **21***b* (see FIG. **3**) of the first embodiment, except for the point that both the left and right ends (for example, the end portion on the left side in FIG. **9**A) are extended to incline downward toward the outer side in the left-right direction.

[0106] The bent portion **221***c* is bent toward the front side from the lower end portion of the hanging portion **221***b* which is positioned on the outer side in the left-right direction with respect to the mounting portion **22***a*. A long hole **221***c***1** extending in the front-rear direction is formed in the bent portion **221***c*, and a bolt **24** is inserted from above into this long hole **221***c***1**.

[0107] The mounting member **222** has the same configuration as the mounting member **22** (see FIG. **3**) of the first embodiment, except for the point that both the left and right ends (for example, the end portion on the left side in FIG. **9**A) of the mounting portion **22***a* are extended toward the outer side in the left-right direction to serve as the fastening portions **222***b*. The fastening portion **222***b* is formed with a female threaded hole **222***b***1**, and the mounting member **222** is fixed to the fixed member **221** by fastening the bolt **24** inserted through the long hole **221***c***1** of the fixed member **221** into the female threaded hole **222***b***1**.

[0108] In this embodiment, the fastening portions **222***b* are also provided on both sides in the left-right direction of the mounting portion **22***a* to which the clamp **104** (foot pedal **100**) is attached, and the fastening portion **222***b* is fastened to the fixed member **221** (bent portion **221***c*) by the bolt **24**. As a result, even when the percussion instrument **201** is installed on the installation surface G, the fastening operation of the bolt **24** can be performed utilizing the relatively wide space S formed on both the left and right sides of the mounting portion **22***a* (between the bent portion **221***c* and the hoop **5**). In other words, the relative position between the percussion instrument **201** and the foot pedal **100** can be easily adjusted without turning the percussion instrument **201** upside down.

[0109] Furthermore, the fastening surfaces between the bent portion **221***c* and the fastening portion **222***b* are planes extending in the horizontal direction, and although not shown in the figure, a pair of bolts **24** provided on the left and right fasten the fastening portions **222***b* at positions where the respective axial centers do not align. Thus, rotation of the mounting member **222** around the bolt **24** as an axis can be suppressed even when the vibration from the foot pedal **100** being stepped on acts on the mounting member **222**. Therefore, it is possible to suppress the relative position between the percussion instrument **201** and the foot pedal **100** from shifting during performance, thus improving the playability of the percussion instrument **201**. Furthermore, since the mounting

member **222** does not rotate around the bolt **24** as an axis, it is possible to suppress the loosening of the bolt **24**. Consequently, as rattling of the mounting member **222** relative to the fixed member **221** is less likely to occur, the playability of the percussion instrument **201** can be improved.

[0110] As shown in FIG. **9**B, the lifter **320** of the percussion instrument **301** of the third embodiment includes a fixed member **321** that is fixed to the shell **2** (see FIG. **1**), and a mounting member **322** that is attached to the fixed member **321**. Each of the fixed member **321** and the mounting member **322** (lifter **320**) has a left-right symmetrical shape.

[0111] The hanging portion **321***b* of the fixed member **321** has the same configuration as the hanging portion **21***b* (see FIG. **3**) of the first embodiment, except for the point that both the left and right ends (for example, the end portion on the left side in FIG. **9**B) are extended toward the outer side in the left-right direction.

[0112] The bent portion **321***c* is bent toward the front side from the upper end portion of the hanging portion **321***b* which is positioned on the outer side in the left-right direction with respect to the mounting portion **22***a*. A female threaded hole **321***c***1** is formed in the bent portion **321***c*, and a bolt **24** is fastened from below into the female threaded hole **321***c***1**.

[0113] The mounting member **322** has the same configuration as the mounting member **22** (see FIG. **3**) of the first embodiment, except for the point that the mounting member **322** includes a bent portion **322***d* that is bent upward from both the left and right ends (for example, the end portion on the left side in FIG. **9**A) of the mounting portion **22***a*, and a fastening portion **322***b* that is bent toward the outer side in the left-right direction from the upper end of the bent portion **322***d*.

[0114] A long hole **322***b***1** extending in the front-rear direction is formed in the fastening portion **322***b*, and the mounting member **322** is fixed to the fixed member **321** by fastening the bolt **24** inserted through this long hole **322***b***1** into the female threaded hole **321***c***1** of the fixed member **321**.

[0115] In this embodiment, the fastening portions **322***b* are also provided on both sides in the left-right direction of the mounting portion **22***a* to which the clamp **104** (foot pedal **100**) is attached, and the fastening portion **322***b* is fastened to the fixed member **321** (bent portion **321***c*) by the bolt **24**. As a result, even when the percussion instrument **301** is installed on the installation surface G, the fastening operation of the bolt **24** can be performed utilizing the relatively wide space S formed on both the left and right sides of the mounting portion **22***a* (between the fastening portion **322***b* and the installation surface G). In other words, the relative position between the percussion instrument **301** and the foot pedal **100** can be easily adjusted without turning the percussion instrument **301** upside down.

[0116] In addition, the fastening surfaces between the bent portion **321***c* and the fastening portion **322***b* are planes extending in the horizontal direction, and although not shown in the figure, a pair of bolts **24** provided on the left and right fasten the fastening portions **322***b* at positions where the respective axial centers do not align. Thus, rotation of the mounting member **322** around the bolt **24** as an axis can be suppressed even when the vibration from the foot pedal **100** being stepped on acts on the mounting member **322**. Therefore, it is possible to suppress the relative position between the percussion instrument **301** and the foot pedal **100** from shifting during performance, thus improving the playability of the percussion instrument **301**. Furthermore, since the mounting member **322** does not rotate around the bolt **24** as an axis, it is possible to suppress the loosening of the bolt **24**. Consequently, as rattling of the mounting member **322** relative to the fixed member **321** is less likely to occur, the playability of the percussion instrument **301** can be improved.

[0117] Next, the percussion instrument **401** of the fourth embodiment will be described with reference to FIG. **10** and FIG. **11**. The first embodiment described above illustrates a case where the outer edge portion of the membrane member **11** and the cushion **12** (striking surface **11***a*) of the attachment **10** is compressed by the head **3** and the plate **30**. In contrast, the fourth embodiment illustrates a case where the outer edge portion of the membrane member **11** and the cushion **12** (striking surface **11***a*) is compressed by the head **3** and an annular member **440**.

[0118] FIG. **10** is an exploded perspective view of the percussion instrument **401** according to the fourth embodiment, and FIG. **11** is a partially enlarged cross-sectional view of the percussion instrument **401**. It should be noted that FIG. **11** illustrates a cross-section cut through a plane including the axis of the fastener **9**, and the illustration of the mounting fittings **6** (see FIG. **10**) is omitted.

[0119] As shown in FIG. **10** and FIG. **11**, the percussion instrument **401** of the fourth embodiment has the same configuration as the percussion instrument **1** of the first embodiment, except for the point that the annular member **440** is provided instead of the plate **30** (see FIG. **6**). Therefore, similar to the first embodiment, the head **3** of the percussion instrument **401** is attached to the shell **2** by the hoop **5** and the mounting fittings **6**, and the attachment **10** is attached to the head **3** by the fasteners **9** which are press-fitted into the press-fit holes **3***b* of the head **3**.

[0120] In a state where the attachment **10** is attached to the head **3**, the annular member **440** is sandwiched between the head **3** and the attachment **10**. The inner diameter of the annular member **440** is formed smaller than the diameter of the through hole **3***a* of the head **3**, while the outer diameter of the annular member **440** is formed larger than the diameter of the through hole **3***a*.

[0121] As shown in FIG. **11**, the annular member **440** includes an outer circumferential portion **441** that is stacked on the front surface of the support membrane **13** on the outer circumference side of the cushion **12**. The outer diameter of the outer circumferential portion **441** (annular member **440**) is formed to be the same as (or slightly smaller than) the inner diameter of the frame **14**. The outer circumferential portion **441** extends to the front side from the support membrane **13** toward the head **3**, and a bent portion **442** is bent from the front end of the outer circumferential portion **441** toward the inner circumference side of the annular member **440**. The bent portion **442** is a portion that extends approximately parallel to the head **3**, and an inclined portion **443** extends toward the inner circumference side of the annular member **440** from the inner edge of the bent portion **442**.

[0122] The inclined portion **443** inclines away from the support membrane **13** toward the inner circumference side of the annular member **440**, and the portion on the inner edge side of the inclined portion **443** protrudes to the front side of the head **3** through the through hole **3***a*. A protruding portion **444** protrudes toward the front side from the inner edge of the inclined portion **443**, and these portions **441** to **444** constituting the annular member **440** are integrally formed using a resin material.

[0123] In the state where the attachment **10** is attached to the head **3**, the outer edge portion of the cushion **12** is compressed by the head **3** and the annular member **440**. The annular member **440** is formed into an annular shape using a material harder than the head **3** (membrane member **11**), making it possible to uniformly regulate the expansion deformation of the outer edge of the cushion **12** over the entire circumference of the cushion **12**. Therefore, the durability of the membrane member **11** and the cushion **12** can be improved.

[0124] In addition, the inclined portion **443** that inclines away from the support membrane **13** toward the inner circumference side of the annular member **440** is formed on the annular member **440**, and this inclined portion **443** presses the outer edge portion of the membrane member **11** and the cushion **12**. Thus, it is possible to gradually reduce the compression amount of the cushion **12** compressed by the annular member **440** (inclined portion **443**) toward the inner circumference side of the cushion **12** while keeping the compression amount large on the outer edge side of the cushion **12**.

[0125] Therefore, in the region on the outer edge side of the cushion **12**, the expansion deformation of the cushion **12** can be effectively suppressed, while the compression amount of the cushion **12** can be reduced on the inner side. In the region where the compression amount of the cushion **12** is small, it becomes difficult for sagging to occur in the cushion **12**, so the durability of the cushion **12** can be improved.

[0126] Although the disclosure has been described above based on the foregoing embodiments, the disclosure is not limited to the above embodiments in any way, and it can be easily inferred that

various improvements and modifications are possible within the scope that does not deviate from the spirit of the disclosure.

[0127] Each of the above embodiments illustrates a case where the percussion instruments **1**, **201**, **301**, and **401** are electronic percussion instruments (electronic drums) each including the sensor **17**, but the disclosure is not necessarily limited thereto. For example, the percussion instruments **1**, **201**, **301**, and **401** may be percussion instruments that do not include the sensor **17**. Furthermore, although each of the above embodiments illustrates the structures of the lifters **20**, **220**, and **320** in the percussion instruments **1**, **201**, **301**, and **401** where the attachment **10** is attached to the head **3**, such structures of the lifters **20**, **220**, and **320** can also be applied to an acoustic bass drum.

[0128] Each of the above embodiments illustrates a case where the lifters **20**, **220**, and **320** (fixed members **21**, **221**, and **321**) are fixed to the outer circumferential surface of the shell **2**, but the disclosure is not necessarily limited thereto. For example, the lifters **20**, **220**, and **320** may be fixed to the hoop **5**. In other words, the fixing positions of the lifters **20**, **220**, and **320** relative to the percussion instruments **1**, **201**, **301**, and **401** (housing) can be appropriately changed.

[0129] Each of the above embodiments illustrates a case where the shapes of the lifters **20**, **220**, and **320** are left-right symmetrical, but the disclosure is not necessarily limited thereto. For example, the shapes of the lifters **20**, **220**, and **320** may be left-right asymmetrical, and the specific shapes of the lifters **20**, **220**, and **320** are not limited to the above-mentioned forms. In other words, the shapes of the lifters **20**, **220**, and **320** can be appropriately changed as long as the configuration allows the fastening portions **22***b*, **222***b*, and **322***b* to be provided on both sides in the left-right direction of the mounting portion **22***a*, and the fastening portions **22***b*, **222***b*, and **322***b* to be fastened at positions where the axial centers of the left and right bolts **24** do not align.

[0130] Each of the above embodiments illustrates a case where the portions of the fixed members **21**, **221**, and **321** or the mounting members **22**, **222**, and **322** are integrally formed by bending a metal plate. However, a portion of the fixed members **21**, **221**, and **321** or the mounting members **22**, **222**, and **322** may be formed separately from other portions.

[0131] Each of the above embodiments illustrates a case where the membrane member **11** and the cushion **12** (that is, the hit body forming the striking surface **11***a*) are disc-shaped, but the disclosure is not necessarily limited thereto. The membrane member **11** and the cushion **12** may be polygonal (for example, rectangular), and in this case, the through hole **3***a* of the head **3**, the support body (support membrane **13**, frame **14**, cushion **15**, mounting plate **16**, etc.), and the annular member **440** may be formed into a shape corresponding to the membrane member **11** and the cushion **12**.

[0132] Each of the above embodiments illustrates a case where the outer edge portion of the cushion **12** is compressed by the head **3** (plate **30** and annular member **440**) in a state before the striking surface **11***a* is hit, but the disclosure is not necessarily limited thereto. For example, the expansion deformation of the outer edge of the cushion **12** can be regulated by the head **3** (plate **30** and annular member **440**) as long as the head **3** (plate **30** and annular member **440**) is at least in contact with the membrane member **11** in the state before the striking surface **11***a* is hit.

[0133] Each of the above embodiments illustrates a case where the plate **30** or the annular member **440**, which is harder than the head **3** (membrane member **11**), is provided between the head **3** and the membrane member **11**, but the disclosure is not necessarily limited thereto. For example, the plate **30** and the annular member **440** may be omitted, or a configuration using both the plate **30** and the annular member **440** (with the plate **30** interposed between the head **3** and the annular member **440**) may be employed. Additionally, the plate **30** may be attached to the front surface of the head **3**.

[0134] Each of the above embodiments illustrates a configuration in which the attachment **10** is attached to the head **3**, that is, a configuration in which the expansion deformation of the outer edge portion of the cushion **12** is regulated by the head **3**, but the disclosure is not necessarily limited thereto.

[0135] For example, a member corresponding to the annular member **440** (a member having a shape that can press the outer edge of the membrane member **11** and the cushion **12**) may be attached to the frame **14**, or may be integrally formed with the frame **14**. In the case of such a configuration, it is possible to regulate the expansion deformation of the outer edge of the cushion **12** with the member corresponding to the annular member **440** while using the attachment **10** itself detached from the head **3** as a percussion instrument (or using the attachment **10** with the sensor **17** removed as a practice pad).

[0136] Each of the above embodiments illustrates a case where multiple (annular fan-shaped) plates **30** are arranged in a ring shape, or a case where the annular member **440** is formed into a ring shape, but the disclosure is not necessarily limited thereto. For example, the multiple plates **30** may be integrally formed into a single ring-shaped plate **30**, or the annular member **440** may be divided into multiple pieces in the circumferential direction.

[0137] Further, the shape of the multiple plates **30** or the annular member **440** is not limited to a ring shape, and the shape of the plates **30** or the annular member **440** can be appropriately changed as long as the through hole **3***a* can be surrounded. Therefore, for example, a single annular plate **30** (or divided into multiple pieces) may be formed by cutting out a circular hole in the center of a polygonal (for example, rectangular) resin plate, or rectangular plates **30** may be arranged into an annular shape.

[0138] Each of the above embodiments illustrates a case where the cushion **15** is sandwiched between the support membrane **13** and the mounting plate **16**, or a case where the sensor **17** is sandwiched between the cushion **15** and the mounting plate **16**, but the disclosure is not necessarily limited thereto. For example, the cushion **15** may be omitted, or the sensor **17** may be attached to the rear surface of the mounting plate **16**.

[0139] Each of the above embodiments illustrates a case where the cushion **12** is formed using a foam material with a higher density than the cushion **15**, but the disclosure is not necessarily limited thereto. For example, the cushion **12** and the cushion **15** may have the same density, or the cushion **12** may be formed using a foam material with a lower density than the cushion **15**. Each of the above embodiments illustrates a case where the overlap margin La with the

[0140] head **3** in the region R including the upper edge of the membrane member **11** is formed larger than the overlap margin Lb with the head **3** in other regions, but the disclosure is not necessarily limited thereto. For example, the overlap margin La in the region R including the upper edge of the membrane member **11** may be smaller than the overlap margin Lb in other regions, or these overlap margins La and Lb may be of the same dimension.

[0141] The first embodiment described above illustrates a case where the left and right fastening surfaces of the lifter **20** are each fastened by one bolt **24**, but the disclosure is not necessarily limited thereto. For example, the left and right fastening surfaces may each be fastened by multiple bolts **24**.

[0142] The first embodiment described above illustrates a case where the bent portion **21***c* and the fastening portion **22***b* are fastened with the bolt **24** above the vertical center C**1** of the left and right fastening surfaces of the lifter **20**, but the disclosure is not necessarily limited thereto. For example, the bolt **24** may be provided at the vertical center C**1** of the fastening surface or below.

[0143] The first embodiment described above illustrates a case where the bent portion **21***c* (fixed member **21**) is fastened to the inner side in the left-right direction of the fastening portion **22***b*, but the disclosure is not necessarily limited thereto. For example, the fastening portion **22***b* (mounting member **22**) may be fastened to the inner side in the left-right direction of the bent portion **21***c*. In this case, the long hole **22***b***1** (see FIG. **2**) is formed in the bent portion **21***c* and the female threaded hole **21***c***1** (see FIG. **2**) is formed in the fastening portion **22***b*, so that it is possible to fasten the bolt **24** from the lateral side of the bent portion **21***c* and the fastening portion **22***b* while allowing adjustment of the fixing position of the mounting member **22** relative to the fixed member **21** in the front-rear direction.

Claims

1. A percussion instrument, comprising: a housing, and a lifter provided on an outer circumference side of the housing, wherein the lifter comprises a fixed member fixed to a housing side, a mounting member configured to have a variable mounting position in a front-rear direction relative to the fixed member, and a bolt fixing the mounting member to the fixed member, the mounting member comprises a mounting portion to which a foot pedal is attached, and fastening portions provided on both sides of the mounting portion in a left-right direction and fastened to the fixed member by a pair of the bolts on left and right sides, and a pair of the bolts fasten the fastening portions at positions where respective axial centers do not align.
2. The percussion instrument according to claim 1, wherein each of the fastening portions inclines upward from the mounting portion toward an outer side in the left-right direction.
3. The percussion instrument according to claim 2, wherein the bolt is provided above a vertical center of fastening surfaces between the fixed member and the fastening portions.
4. The percussion instrument according to claim 2, wherein the fixed member is fastened to an inner side in the left-right direction of the fastening portions.
5. The percussion instrument according to claim 2, wherein the mounting portion and the fastening portions are formed by bending a metal plate.
6. The percussion instrument according to claim 2, wherein the fixed member comprises a fixed portion fixed to the housing side, a hanging portion hanging downward from the fixed portion, and bent portions which are bent toward a front side from both left and right end sides of the hanging portion and to which the fastening portions are fastened.
7. The percussion instrument according to claim 6, wherein the fixed portion, the hanging portion, and the bent portions are formed by bending a metal plate.
8. The percussion instrument according to claim 1, wherein the fixed member comprises a hanging portion with left and right ends extended to incline downward toward an outer side in the left-right direction.
9. The percussion instrument according to claim 8, wherein left and right ends of the mounting portion are extended toward the outer side in the left-right direction to serve as fastening portions.
10. The percussion instrument according to claim 1, wherein the fixed member comprises a hanging portion with left and right ends extended toward an outer side in the left-right direction.
11. The percussion instrument according to claim 10, wherein the mounting member includes bent portions bent upward from left and right ends of the mounting portion, and fastening portions bent toward the outer side in the left-right direction respectively from upper ends of the bent portions.
12. A mounting method for a mounting member in a percussion instrument, which comprises a housing, and a lifter provided on an outer circumference side of the housing, wherein the lifter comprises a fixed member fixed to a housing side, the mounting member configured to have a variable mounting position in a front-rear direction relative to the fixed member, and a bolt fixing the mounting member to the fixed member, and the mounting member comprises a mounting portion to which a foot pedal is attached, and fastening portions provided on both sides of the mounting portion in a left-right direction and fastened to the fixed member by a pair of the bolts on left and right sides, the mounting method comprising: attaching the mounting member to the fixed member by fastening the fastening portions with a pair of the bolts whose axial centers do not align.
13. The mounting method for the mounting member according to claim 12, wherein each of the fastening portions inclines upward from the mounting portion toward an outer side in the left-right direction.
14. The mounting method for the mounting member according to claim 13, wherein the bolt is provided above a vertical center of fastening surfaces between the fixed member and the fastening

portions.
15. The mounting method for the mounting member according to claim 13, wherein the fixed member is fastened to an inner side in the left-right direction of the fastening portions.
16. The mounting method for the mounting member according to claim 13, wherein the mounting portion and the fastening portions are formed by bending a metal plate.
17. The mounting method for the mounting member according to claim 13, wherein the fixed member comprises a fixed portion fixed to the housing side, a hanging portion hanging downward from the fixed portion, and bent portions which are bent toward a front side from both left and right end sides of the hanging portion and to which the fastening portions are fastened.
18. The mounting method for the mounting member according to claim 17, wherein the fixed portion, the hanging portion, and the bent portions are formed by bending a metal plate.
19. The mounting method for the mounting member according to claim 12, wherein the fixed member comprises a hanging portion with left and right ends extended to incline downward toward an outer side in the left-right direction.
20. The mounting method for the mounting member according to claim 19, wherein left and right ends of the mounting portion are extended toward the outer side in the left-right direction to serve as fastening portions.