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Shirai et al.

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(54) **BUCKLE AND BAND WITH THIS BUCKLE**

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(52) **U.S. Cl.** **24/16 PB**

(58) **Field of Search** 24/16 PB, 17 AP, 24/30.5 P; 2/416-421; 248/74.3

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(57) **ABSTRACT**

A band has an engaging projection part at one end, and an engaging grooves at the other end to adjust the connection in an annular shape. The band is movable forward but not movable backward relative to the other under the condition that the engaging projection part is locked to the engaging recessed part. A pair of hook parts capable of pulling both end parts by fingers of one hand is installed on both end parts. A buckle connected to the band includes a buckle main body having a bottom plate, a roof frame, and side plates for connecting the bottom plate to the roof frame. An operating plate is installed horizontally inside the roof frame, and has an engaging claw engageable with the band engaging grooves and a pressing part. The buckle and the band is made simple, and easily attached together.

7 Claims, 10 Drawing Sheets

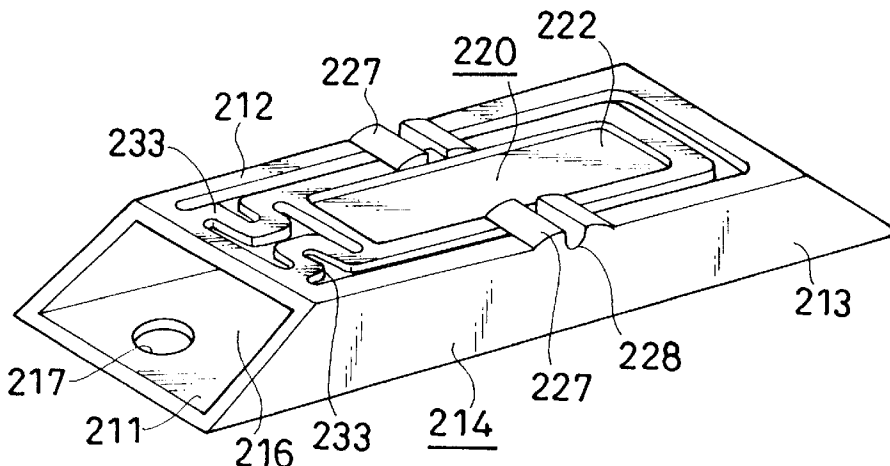


Fig.1(a)

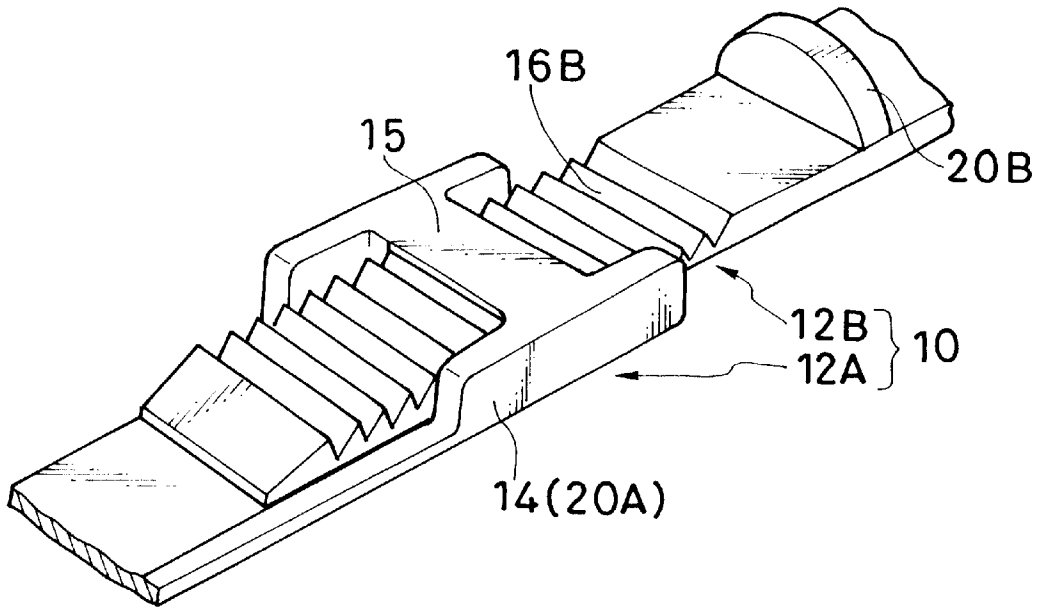


Fig.1(b)

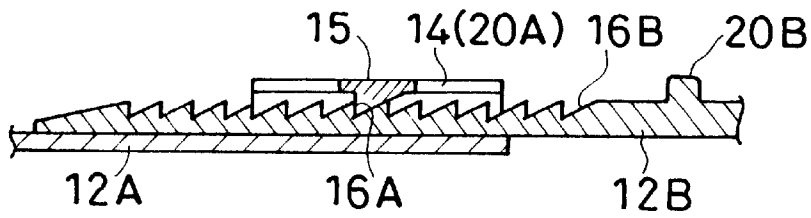


Fig.1(c)

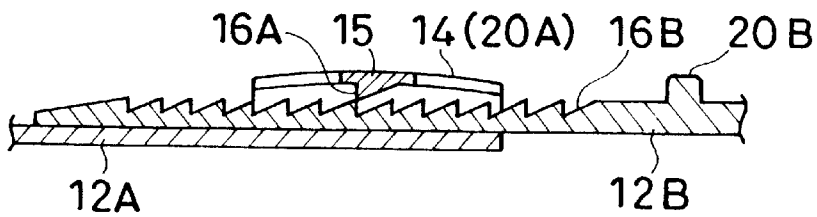


Fig. 2(a)

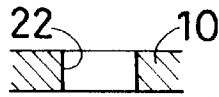


Fig. 2(b)

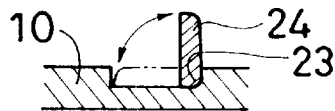


Fig. 2(c)

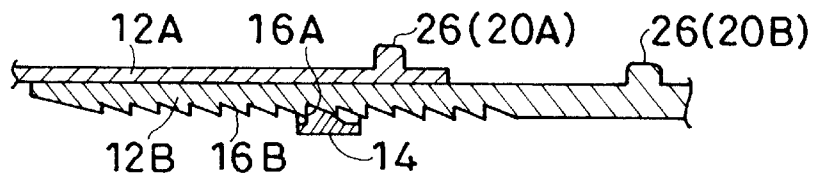


Fig. 3

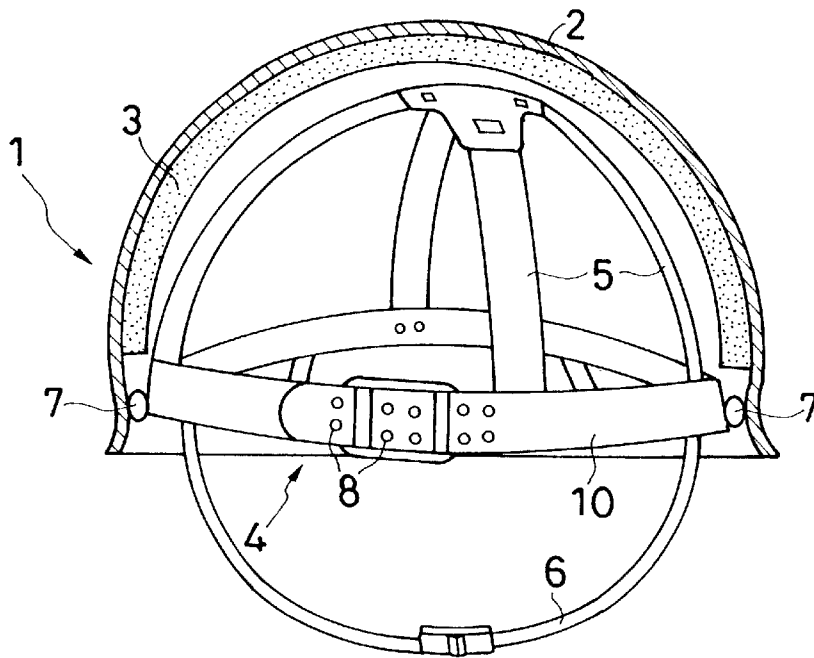


Fig. 4 (a)

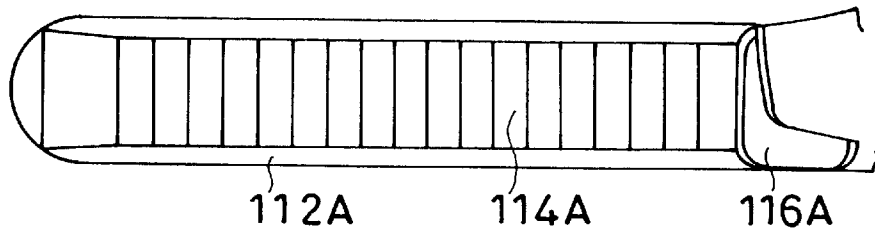


Fig. 4 (b)

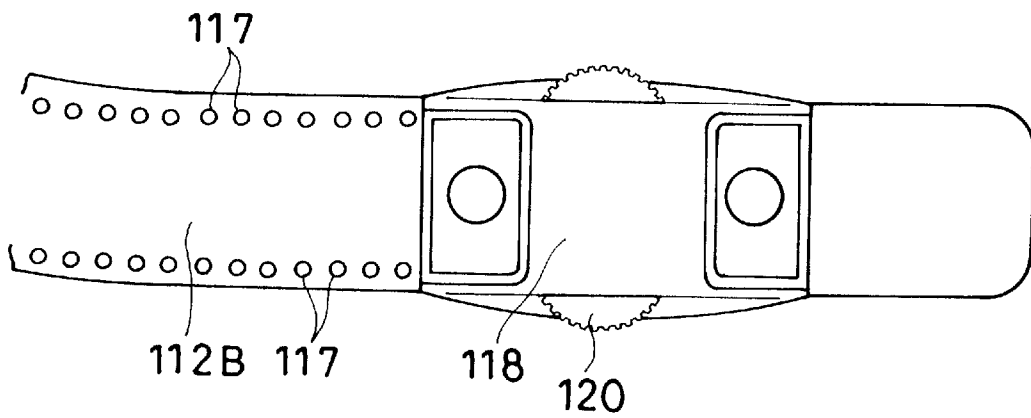


Fig. 5

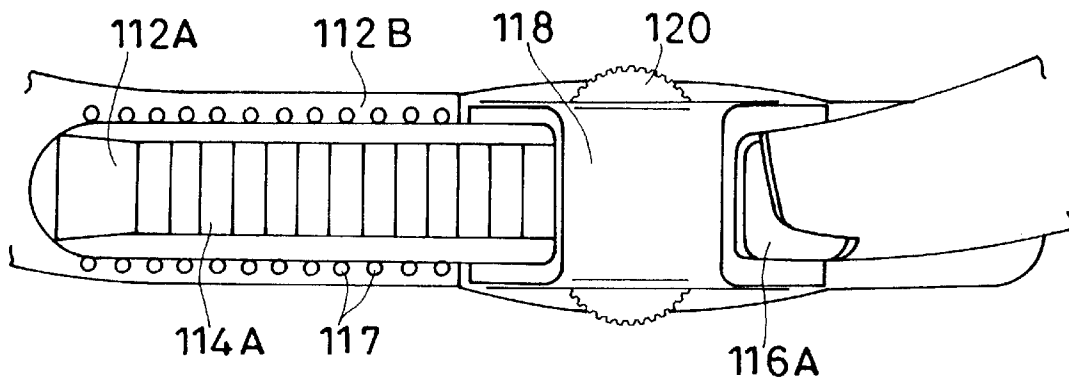


Fig. 6

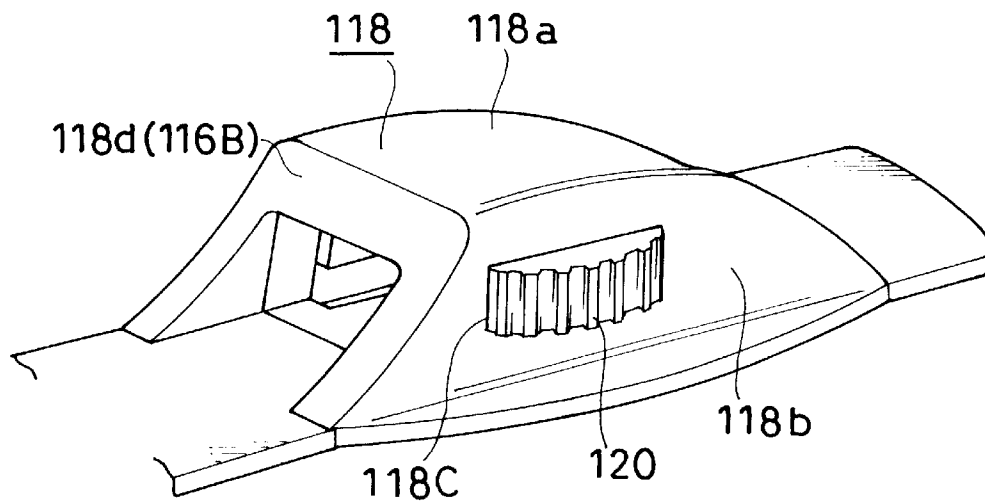


Fig. 7

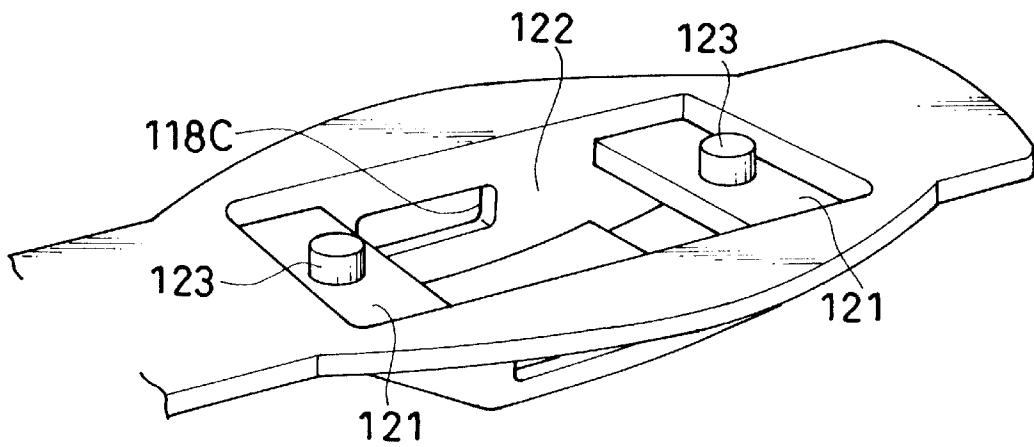


Fig. 8

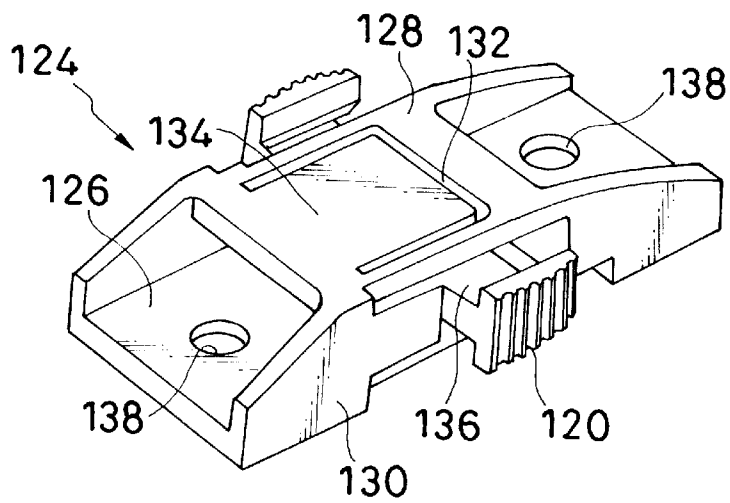


Fig. 9 (a)

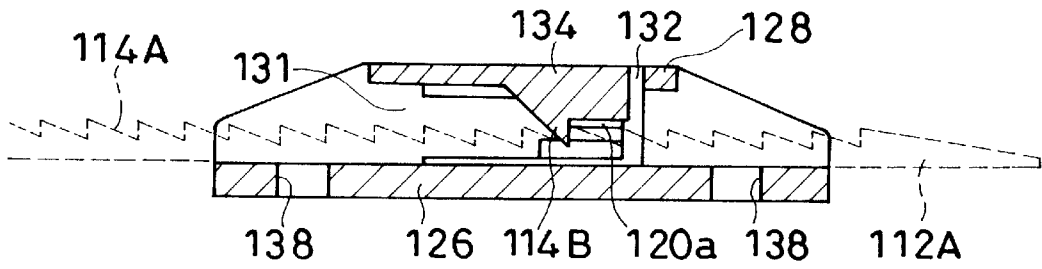


Fig. 9 (b)

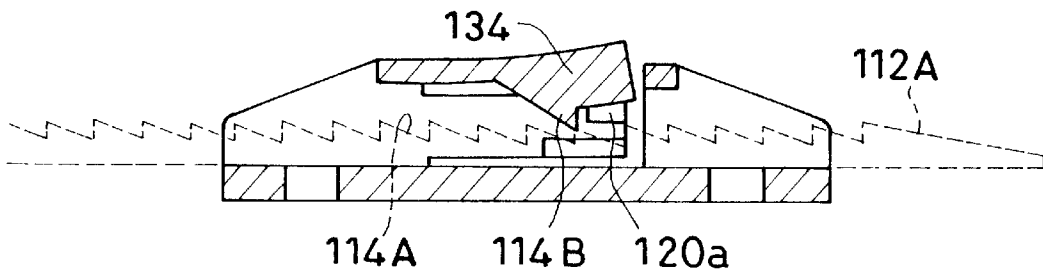


Fig.10

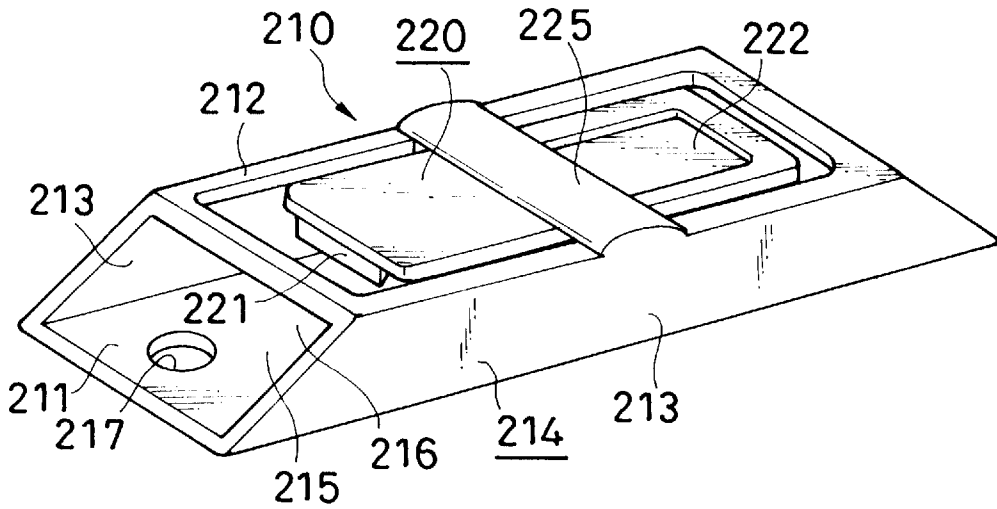


Fig.11(a)

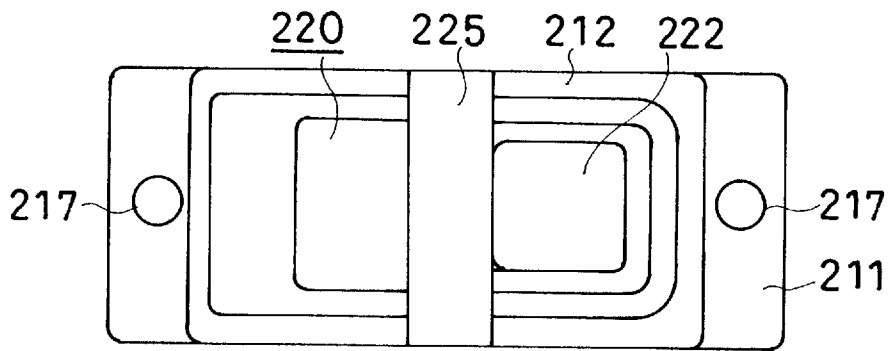


Fig.11(b)

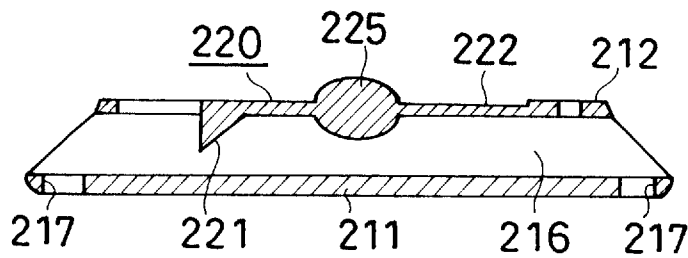


Fig. 12(a)

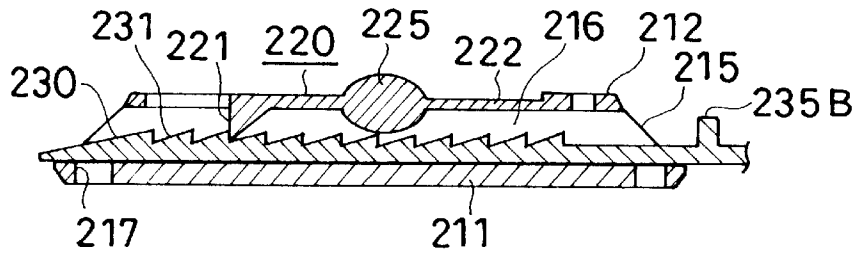


Fig. 12(b)

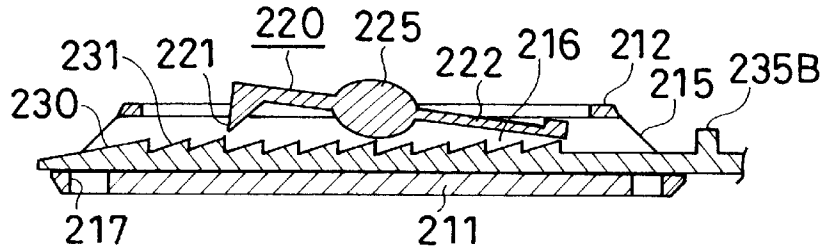


Fig. 13

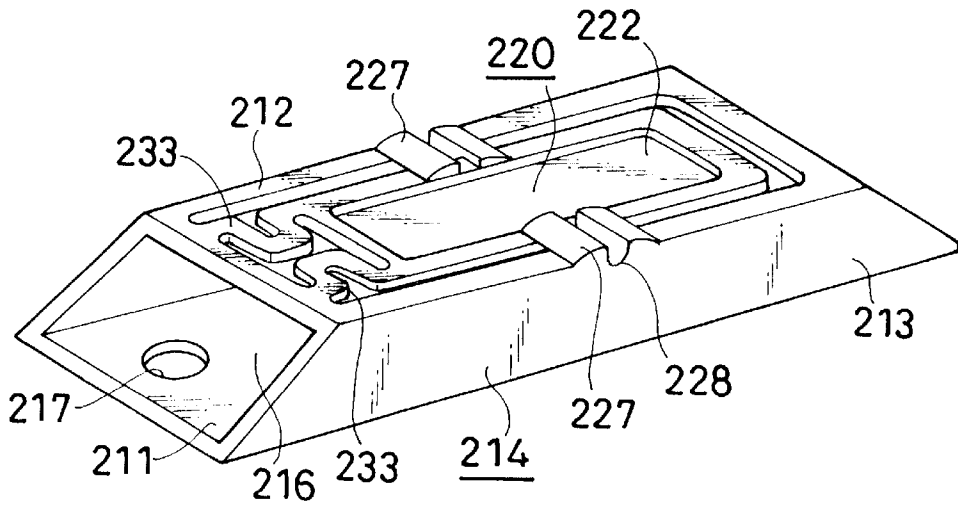


Fig. 14

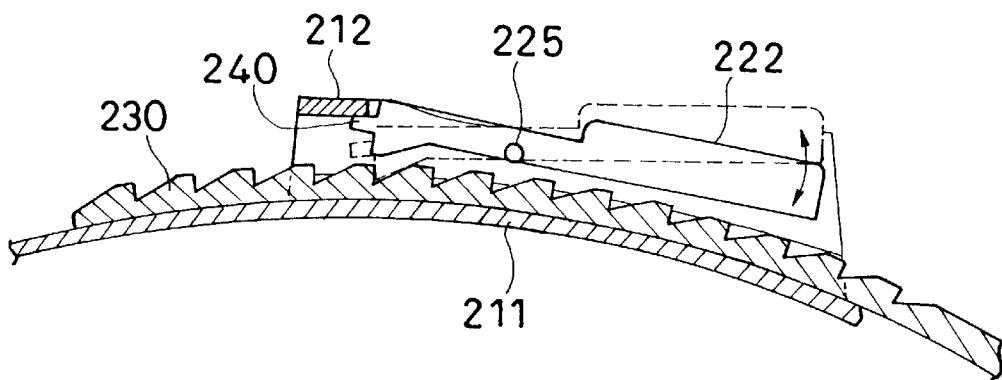


Fig. 15(a)

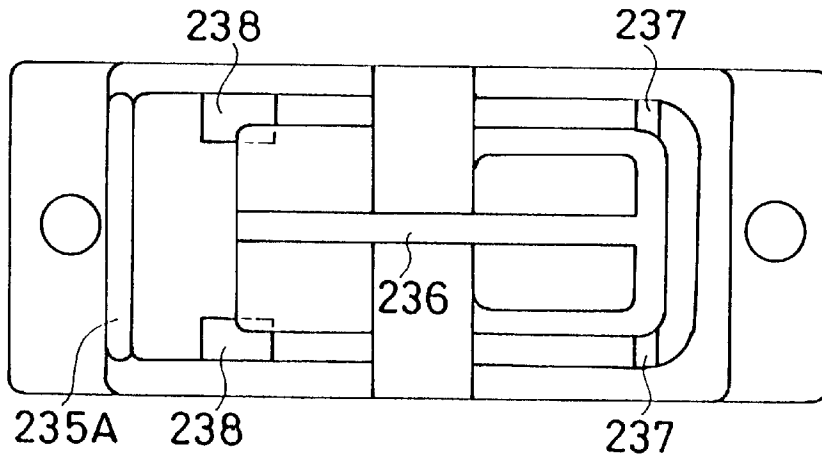


Fig. 15(b)

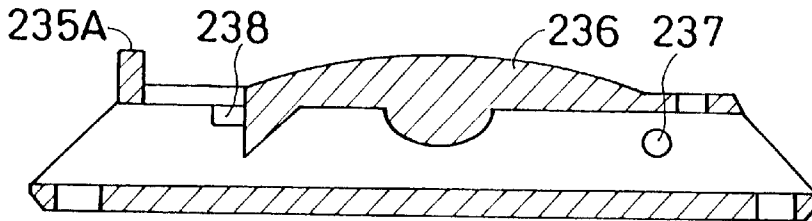
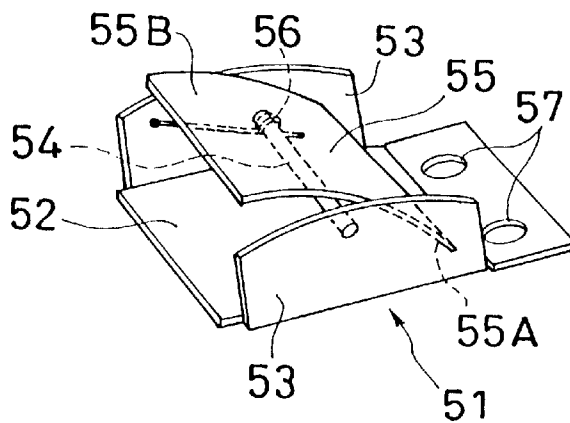


Fig. 16 Prior Art



BUCKLE AND BAND WITH THIS BUCKLE**FIELD OF THE INVENTION**

The present invention relates to structure of a band (or a belt) having a buckle at its joint edge section, and more specifically relates to a band used as a head band for a helmet, a watch band, a band for trousers or a skirt, or a band for shoes or a bag.

The present invention also relates to a buckle for locking a band having an engagement groove, and more specifically to a buckle for a band or a belt such as a head band for a helmet, a watch band, a band for trousers or a skirt, or a band for shoes or a bag.

BACKGROUND TECHNOLOGY

A head band for a helmet is set around a head of a wearer and plays a role for locking the helmet to the head.

FIG. 3 shows an ordinary helmet 1 for working, and is a perspective view in section showing a cap body 2, an internal setting body 4 penetrating a liner 3 adhered thereto for absorbing shock. The setting body 4 comprises a cross-like hammock 5, a head band 10 connected in a circular form, and a jaw strap 6, and this setting body 4 is set via brackets 7, 7 to the cap 2 to form the helmet 1.

It is necessary to adjust a peripheral length of the head band 10 for adjusting the size to the size of the wearer's head. In this example based on the conventional technology, a number of small projections 8, 8 . . . are provided at an even space in one edge section of the head band 10, while small holes engaging with the small projections 8, 8 . . . respectively are provided in the longitudinal direction of the head band 10, and the peripheral length can be adjusted by engaging the projections in the small holes appropriately.

As the sizes of the small projections and small holes are small, it is not easy to set or remove the headband 10, and the work for adjusting the head band 10 in the rear section of the head is extremely difficult when the helmet 1 is set on the wearer's head.

On the other hand, when it is required to adjust a peripheral length of a head band, a size-adjustable band employing the pinion rack system therein (Refer to Japanese Patent Laid-Open Publication No. HEI 8-27613), or a head band for a helmet in which a worm screw mechanism is incorporated on the head band for enabling fine adjustment (Refer to Japanese Patent Laid-Open Publication No. HEI 7-293515) is available.

The head band adjustment mechanism shave, however, the defect that, as the construction becomes more complicated, the weight of the helmet disadvantageously increases.

When any of a watch, an arm ring, a portable information terminal such as a personal computer, a tonometer, trousers, or a skirt is worn around wearer's arm, leg, or trunk, the peripheral length is adjusted with the band in loading on or off. It is not easy, however, to loading on or off the band with a single hand, and especially it is extremely difficult to adjust the band in the rear section of the wearer's head which is hardly visible, during night, or at a dark place.

In a case of a watch band, sometimes an intermediate catch is provided in the middle of the watch band so that the wearer can set the band or remove it with one hand by operating the catch with claws of finger tips. However, the work for loading on or off a watch with the intermediate catch is difficult for a person with short claws or a person with a weak power, and improvement of the intermediate catch will result in complication of its mechanism and structure.

Further there has been known a buckle with an engagement groove, in which a buckle hook is resiliently hooked. In this type of buckle, the wearer can disengage the hooking at will.

FIG. 16 is a perspective view showing a representative buckle of this type. A buckle body 51 comprises a bottom plate 52 and side plates 53, 53 and has a substantially \sqcap -shaped cross section. Shaft 54 is spanned over the side plates 53, 53 with a cover piece 55 attached to the shaft 54. An edge 55A of the cover piece 55 is biased by a coil spring 56 to the bottom plate 52, and the other edge 55B of the cover piece 55 is used as a section for pressing. Further the buckle has a hole 57 or the like, which is used for attaching the buckle to a basic body of a bag, shoes, or various types of bands. On the other hand, in a band used as a pair with the buckle, engagement grooves each having a cross section like saw teeth and extending in the longitudinal direction are provided side by side, and the band is inserted into a space formed between the buckle body 51 and the cover piece 55.

With the buckle structure as described above, when the band is passed through the space, the band pushes the cover piece 55 upward against a springing force of the coil spring 56, and when insertion of the band is stopped at a desired fastening position, an edge 55A of the cover piece 55 hooks in the engagement groove of the band, and movement of the band in the pulling-off direction is limited. When pulling off the band, the other edge 55B of the cover piece 55 is pushed down to the buckle body 51, and with this operation the edge 55A is raised from the engagement groove of the band, thus the band being disengaged from the buckle.

The conventional type of buckles have many components, so that the work for assembling the buckle is time-consuming and complicated, and in addition the buckles are metallic, so that the weight is heavy. Therefore such types of buckles can not satisfy the current demands for weight reduction. In addition, as the mechanism for releasing the engagement between the buckle and the band by pressing from upside of the buckle body to the bottom plate is employed, and because of this structural feature, sometimes the band may be disengaged from the buckle due to unexpected contact of the buckle to something.

DISCLOSURE OF THE INVENTION

It is an object of the present invention to provide a buckle and a band with this buckle based on a simple structure which can easily be loaded on or off.

In one embodiment, the band according to the present invention has a protruding section for engagement at its one edge section and a recessed section also for engagement at the other edge section thereof, and is connected into a circular form by engaging the two sections for engagement and sliding the two edge sections to adjust its peripheral length. When the protruding section for engagement is hooked in the recessed section for engagement, the other edge section can freely move forward against the one edge section, but can not move backward, and a pair of hooking sections, with which the wearer can pull up the two edge sections with fingers of a hand, is provided at the two edge sections on a top surface of the band.

In another embodiment, the band according to the present invention has a groove for engagement at its one edge section and a claw for engagement at the other edge section, and is set into a circular form by engaging the engagement groove with the engagement claw and sliding the two edge sections of the band for adjusting the peripheral length. A resilient piece having the engagement claw is provided in

parallel to the other edge section, and when the engagement claw is hooked in the engagement groove, the one edge section can freely move forward against the other edge section, but can not move backward. However, the engagement can be disengaged from the engagement groove by operating the resilient piece, and the resilient piece is made from a material harder than the material for the two edge sections of the band.

The buckle made from synthetic resin according to the present invention has a buckle body and an operation plate. The buckle body comprises a bottom plate, a ceiling frame opposite to the bottom plate and two side plates connecting the bottom plate and the ceiling frame to each other, and the buckle body has a space for insertion of a band with an engagement groove. The operation plate is provided inside the ceiling frame in the horizontal position and has an engagement claw for engagement with the engagement groove of the band on a bottom surface of its one edge and a top surface at the other edge used as a pressed section. By jointing the operation plate to opposite two edges of the ceiling frame at a middle point between the engagement claw and the pressed section, the operation plate can freely be swung at the middle point as a fulcrum.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1(a) is a perspective view showing a state in which two edge sections of the band according to the present invention are engaged with each other, while FIG. 1(b) is a longitudinal side view showing the cross section thereof cut in the peripheral direction. FIG. 1(c) is a longitudinal side view showing the cross section in the state where the engagement is released;

FIGS. 2(a)–2(c) are cross-sectional views showing an edge section of the head band;

FIG. 3 is a longitudinal side view showing inside of a general helmet for works;

FIGS. 4(a) and 4(b) are partial front views showing a state in which two edge sections of a head band are separated from each other;

FIG. 5 is a front view showing a state in which the two edge sections of the head band are engaged with each other;

FIG. 6 is a perspective view showing a hood provided at the other edge section of the band;

FIG. 7 is a perspective view showing the other edge section viewed from the bottom plate side;

FIG. 8 is a perspective view showing an engagement section accommodated inside the hood;

FIGS. 9(a) and 9(b) are cross-sectional views of the engagement section, and FIG. 9(a) shows the engaged state, while FIG. 9(b) shows the disengaged state;

FIG. 10 is a perspective view of a buckle;

FIG. 11(a) is a flat view showing the buckle in FIG. 10, while FIG. 11(b) is a cross-sectional view showing the same;

FIGS. 12(a) and 12(b) are cross-sectional views illustrating operations of the buckle;

FIG. 13 is a perspective view showing a buckle according to another embodiment of the present invention;

FIG. 14 is a cross-sectional view showing the buckle in FIG. 13;

FIG. 15(a) is a flat view showing the buckle in FIG. 11 according to still another embodiment of the present invention, while FIG. 15(b) is a cross-sectional view showing the same; and

FIG. 16 is a perspective view showing an example of a buckle based on the conventional technology.

BEST MODE FOR CARRYING OUT THE INVENTION

The best mode for carrying out the invention is described below with reference to a head band as the best example thereof shown in the drawings.

FIG. 1(a) is a perspective view showing a state where two edge sections of a head band **10** are engaged with each other, while FIG. 1(b) is a longitudinal side view showing the same in the peripheral direction. For convenience in description, an edge section having a protruding section for engagement is described as one edge section **12A**, and a section with a recessed section for engagement is described as the other edge section **12B**.

A slide guide **14** having a looped portion is provided in the one edge section **12A** which makes the other edge section **12B** possible to insert easily therein or to prevent, and a claw-shaped protruding engagement section **16A** is formed inside a stop ring **15** of the slide guide **14** as shown in FIG. 1(b).

On the other hand, a recessed engagement section **16B** having a sawtoothed cross section is provided on a top surface of the other edge section **12B**. With the configuration, the two engagement sections **16A**, **16B** are engaged with each other by sliding the two edge sections **12A**, **12B**, and the head band **10** is set to a circular form by adjusting the length thereof to that appropriate for the wearer. When the claw-formed engagement protruding section **16A** is hooked in the recessed engagement section **16B** having a sawtoothed cross section, the other edge section **12B** can freely move forward against the one edge section **12A**, but can not move backward.

At the other edge section **12B**, a hooking section **20B** is provided in the protruding form at the back of the recessed engagement section **16B** on a top surface thereof. The hooking section **20B** is required only to have a size and a form enough to be gripped by finger tips. Therefore, in addition to the semi-cylindrical form shown in the figure, the hooking section may have a cylindrical or a rectangular column form. Further a through-hole **22** penetrating from an outer surface to an inner surface of the head band **10** as shown in FIG. 2(a) may be provided, or a hinge **24** supported by a pin **23** as a fulcrum as shown in FIG. 2(b) may be used. protruding slightly from an outer surface of the one edge section **12A** is provided at the one edge section **12A**, so that the slide guide **14** can be used as a hooking section **20A** for the one edge section **12A**. In this invention, however, the slide guide **14** is not always required, and for the head band **10** not having a portion like the hooking section **20A** for the slide guide **14**, an independent hooking section **20A** may be provided also at the one edge section **12A**.

Even in a case where the slide guide **14** is provided at the one edge section **12A** as shown in FIG. 2(c), a projection **26** as the hooking section **20A** may be provided at the one edge section **12A**.

It is to be noted that the head band **10** is fabricated with such materials as polyvinyl chloride, polyethylene, other flexible synthetic resins, or hard rubber. In this step, it is preferable to previously form a curved surface matching a periphery of the wearer's head on the head band **10**.

The head band **10** according to this embodiment has the configuration as described above, so that, by hooking finger tips of a hand in the stop ring **15** as the hooking section **20A** and the hooking section **20B**, and by pulling them closer to each other, the other edge section **12B** goes into the slide

guide **14** with the engagement sections **16A** and **16B** rubbing each other, thus a peripheral length of the head band **10** being adjusted to the required length.

In this state, even if the other edge section **12B** is pulled away from the one edge section **12A**, the other edge section **12B** does not move because the two engagement sections **16A** and **16B** are engaged with each other.

When the engagement between the two engagement sections **16A** and **16B** is released and the other edge section **12B** is pulled off from the one edge section **12A**, it is required only to press side sections of the slide guide **14** (especially at the position of the stop ring **15**) from the outside with fingers, and bend the stop ring **15** to the outer side (to the upper side in FIG. **1(a)** and FIG. **1(b)**). With the operation above, engagement between the two engagement sections **16A** and **16B** are released as shown in FIG. **1(c)**, so that the other edge section **12B** moves backward to the one edge section **12A**, and the head band **10** being loosened naturally.

There is no specific restriction over a hooking style at the two edge sections of the head band **10**. Therefore, in addition to the configuration according to the embodiment as described above, the present invention can be applied to a head band with the other edge section **12B** of the head band **10** allowable to move only in one direction to or away from the one edge section **12A** when the two engagement sections are engaged with each other by providing the pair of hooking sections **20A**, **20B** described above thereon.

With the head band according to the present invention, the size can be adjusted only with finger tips of one hand when the head band is set on a wearer's head. Therefore, with this head band, it is possible to quickly, easily, and accurately load on or off the helmet.

Further, as the structure of the head band is quite simple, the production cost is low with weight increase of the helmet suppressed.

A head band according to another embodiment of the present invention is described below. For convenience in the following description, a direction in which each edge section advances when two edge sections of the head band are engaged is described as forward direction, and a direction in which each edge section moves back is described as backward direction.

FIGS. **4(a)** and **4(b)** are partial front views showing a state in which two edge sections of a head band **110** are separated from each other, and FIG. **5** is a front view showing a state in which the two edge sections of the head band **110** are engaged with each other. In FIGS. **4(a)** and **4(b)**, engagement grooves **114A** having a sawtoothed cross section are formed on an outer surface of one edge section **112A** shown in FIG. **4(a)**. Further at the back of the engagement grooves **114A** on an outer surface of the one edge section **112A**, there is provided a hooking section **116A** protruding therefrom and having a hook-like front section. The hooking section **116A** is required only to have the size and form allowing hooking of the wearer's finger tips therein. Therefore, in addition to the configuration shown in the figure, the hooking section **116A** may have a form of a cylindrical or semi-cylindrical column. Further a through-hole penetrating the head band from its outer surface to its inner surface may be provided.

Provided on the outer surface of the other edge section **112B** of the head band shown in FIG. **4(b)** is a hood **118**. The hood **118** has a top wall **118a** expanding to the outer peripheral side of the head band as shown in FIG. **6**, which is the perspective view, and has openings in the front and rear sections, and the one edge section **112A** of the head

band can be passed through the openings. On a pair of side walls **118b**, **118b** constituting the hood **118**, there are provided open windows **118c**, **118c**, in which a push button **120** described hereinafter can be engaged with a certain degree of allowance.

It is possible to prevent the push button from being pressed carelessly by providing a protrusion not shown in the figure entirely or partially along a periphery of the open window **118c** on the side walls **118b**, **118b**.

In this embodiment, a rear edge section (the left edge section in FIG. **6**) **118d** of the top wall **118a** is used as a hooking section **116B** which is to be provided at the other edge section **112B**. However, the hood is not essential in this invention, and therefore in the head band **110** not equipped with the hooking section **116B** like the rear edge section **118d** of the top wall **118a**, it is preferable to provide a separated hooking section **116B** also at the other edge section **112B**.

As shown in FIG. **4(b)**, band holders **117** are provided at the back of the hood **118** on the outer surface of the other edge section **112B** along upper and lower rims of the other edge section **112B**. It is preferable that each of the band holders **117** comprises a short shaft section and a head section having a diameter larger than that of this shaft section and has the so-called mushroom form. By providing the band holders **117** side by side along the upper rim and lower rim of the other edge section **112B**, it is possible to closely press and fit the one edge section **112A** of the head band **110** having passed through the hood **118** to the outer surface of the other edge section **112B**. The mushroom-shaped band holder **117** is especially advantageous in the point that the one edge section **112A** can be held and fixed only by pressing it with a finger tip.

FIG. **7** is a perspective view showing the other edge section **12B** seen from the bottom plate side. Inside of the hood **118** is a space **122** in which the engagement section **124** described in detail below is accommodated, and stop pins **123**, **123** are provided in the vertical position from the partially raised bottom surface **121** of the band.

FIG. **8** is a perspective view showing the engagement section **124** accommodated in the space **122** inside the hood **118**, and FIG. **9** is a longitudinal side view of the engagement section **124**.

The engagement section **124** mainly comprises a bottom wall section **126** and a head wall section **128** opposite to each other and two side wall sections **130**, **130** also opposite to each other, and an insertion space **131** into which the one edge section **112A** of the head band is inserted is defined by these four wall sections.

A resilient piece **134** is provided on the head wall section **128** by forming a \sqcap -shaped slit **132**, and an engagement claw **114B** is provided in the protruding state on an inner wall of this resilient piece **134** at its head section. In this embodiment, the resilient piece **134** is provided in parallel to the bottom wall section **126**, so that the engagement section **124** does not substantially protrude to the outer periphery of the other edge section **112B**, which enables the compact structure.

Side pores **136**, **136** each communicating to the insertion space **131** are provided on the two side wall sections **130**, **130**, and push buttons **120**, **120** are provided at the extended edges of the two side wall sections **130**, **130** at positions opposite to the side pores **136**, **136** respectively. The push buttons **120**, **120** are elastically deformed inward to the insertion space **131** and contact side sections of the resilient piece **134**, thus a tip of the resilient piece **134** being deformed outward from the insertion space **131**.

In this embodiment, the push buttons **120** are provided at the extended edge of the side wall section **130**, but the push buttons **120** may be provided at any positions on the conditions that the push buttons face the side pores **136**, and for instance, a portion of the side wall **118b** of the hood **118** may be formed with a resilient body so that the portion can function as the push button **120**.

The engagement section **124** can be formed into an integrated body by using such synthetic resin as polyacetal, polyoxymethylene, polyamide, polycarbonate. Especially it is necessary to form the resilient body **134** with any synthetic resin so that its free edge side (at which the engagement claw **114B** is provided) can swing in the vertical direction. In contrast, as the head band **110** including the two edge sections **112A** and **112B** directly contact the wearer's head, it is desirable to fabricate it with such soft and flexible synthetic resin as polyvinyl chloride, polyethylene and polypropylene, or with hard rubber.

Therefore in the head band according to the present invention, the resilient piece **134** is made with a material relatively harder as compared to a material used for forming the two edge sections **112A** and **112B** of the head band.

Alternatively, a synthetic resin material suited to each portion may be employed by forming the head band including the two edge sections **112A**, **112B** and the engagement section **124** including the resilient piece **134** as independent bodies respectively.

The engagement section **124** is accommodated in the space **122** within the hood **118** and integrated with the other edge section **112B** by engaging round holes **138**, **138** provided at two sections on the bottom wall section **126** with the stop pins **123**, **123**.

The head band **110** according to the present invention is set to a circular form by sliding the two edge sections **112A**, **112B** to hook the engagement claw **114B** in the engagement groove **114A** for adjusting the length of the head band **110** to that suited to the wearer. Thus, as the head band **110** according to the present invention has the configuration as described above, when the wearer aligns the one edge section **112A** with insertion holes on the hood **118** and pulls closer to each other the hooking section **116A** of the one edge section **112A** and a rear edge section **118d** of the hood **118** as the hooking section **116B** for the other edge section **112B** with finger tips of a hand, the engagement groove **114A** contacts the engagement claw **114B** of the resilient piece **134**, and the one edge section **112A** advances raising the resilient piece **134**, thus a peripheral length of the head band **110** being adjusted to the appropriate length.

In this state, as the engagement claw **114B** is hooked in and engaged with the engagement groove **114A** as shown in FIG. **9(a)**, the other edge section **112B** can freely move forward to the one edge section **112A**, but can not move backward, so that engagement between the two edge sections **112A** and **112B** is not loosened.

To loosen the head band **110** or to separate the two edge sections **112A** and **112B** from each other, the push buttons **120**, **120** protruding from the side walls **118b** of the hood **118** are pressed inward with fingers. With this operation, tip sections **120a** of the push buttons **120**, **120** contact side sections of the resilient piece **134** with the tip of the resilient piece **134** deformed outward from the insertion space **131**. As a result, the engagement claw **114B** is disengaged from the engagement groove **114A**, so that the head band **110** can be loosened or the one edge section **112A** can be separated from the other edge section **112B**. In this embodiment, although the hooking sections **116A**, **116B** are pushed in the

horizontal (lateral) direction when two edges of the head band **110** are connected to each other, the push buttons **120**, **120** are pushed in the vertical (longitudinal) direction for releasing the engagement between the two edge sections, so that the wearer can easily distinguish the operation for engagement from the operation for disengagement.

With the band described with reference to FIG. **4(a)** to FIG. **9(b)**, an operation for adjusting a peripheral length of the band is quite easy, and operations for engagement and disengagement can be performed without fail. In addition, as the structure of the head band is extremely simple, the production cost is low and weight of a helmet used together with the head band does not increase.

As the sections operated for engagement are covered with a hood, the engagement is never released carelessly or unexpectedly. Further malfunction due to entry of dusts or other foreign materials into the section operated for engagement never occurs.

The best example of the buckle made from synthetic resin according to the present invention is described below.

FIG. **10** is a perspective view showing a buckle **210** according to the present invention, and FIG. **11(a)** is a flat view showing the buckle, while FIG. **11(b)** is a sectional view showing the same. In these figures, a main body of the buckle **210** comprises a flat and trapezoidal buckle body **214** in turn comprising a bottom plate **211**, a ceiling frame **212** opposite to the bottom plate **211**, and side plates **213**, **213** connecting the bottom plate **211** to the ceiling frame **212**. The buckle body **214** has an insertion port **215** in the direction in which the band slides, and the inside is an insertion space **216** having an engagement groove in which the band **230** is inserted.

In this embodiment, a length of the bottom plate **211** in its longitudinal direction (in which the band slides) is larger than that of the ceiling frame **212** in its longitudinal direction, so that a body to be connected to the buckle **210** not shown (namely a head band for a helmet, a band for a bag or the like) can easily be attached to the holes **217**, **217** formed on the bottom plate **211**, and also insertion of the band can be executed smoothly.

An operation plate **220** with the size smaller than that of the ceiling frame **212** is accommodated in the horizontal position inside of the ceiling frame **212**. A protruding hooking claw **221** engageable in an engagement groove on the band **230** is provided on a lower surface of one edge section of the operating plate **220**, while a top surface of the other edge section functions as a pressing section **222**, and the central section is preferably recessed as compared to the peripheral section. As the operation plate **220** is located at a slightly lower position than the ceiling frame **212**, the pressing section **222** is prevented without fail from being depressed carelessly.

A joint shaft **225** is formed at the middle of the operation plate **220** in its longitudinal direction, and this joint shaft **225** is connected to two opposite edges of the ceiling frame **212**. In this embodiment, a cross section of the joint shaft **225** is an oval form, but the form may be a different one as circle or others. This joint shaft **225** swingingly supports the operation plate **220**, and may have any form on the condition that it is never broken when swung reciprocally. It is to be noted that the joint shaft **225** is not always required to be jointed to two edges of the ceiling frame **212**, and even when it is connected to upper portions of the side plates **213**, **213**, it can show the same effect as that described below.

The buckle **210** may be formed with any flexible synthetic resin, and especially as the operation plate **220** is swung

around the joint shaft **225**, it is preferable to fabricate the buckle **210** with such a synthetic resin material as polyacetal, polyoxymethylene, polyamide, or polycarbonate by way of casting. The buckle **210** according to this invention comprises only a few components, and because of its simple structure, it can easily be formed into an integral body with a die.

Operations of the buckle **210** are described with reference to FIG. **12**.

FIG. **12(a)** shows a state in which the band **230** is inserted into the insertion space **216** of the buckle **210** and the engagement claw **221** of the buckle **210** is engaged in an engagement groove **231** formed on an outer surface of the band **230**. The engagement groove **231** comprises a tapered surface having a sawtoothed cross section in the sliding direction, namely a cross section becoming deeper in the direction in which the band **230** advances, and a wall surface erecting in the substantially vertical direction from the deepest position. The reference numeral **235B** indicates a hooking protrusion provided on the band **230**, which is described hereinafter.

When the band **230** is inserted from the insertion port **215** in the side of the pressing section **222** (in the right side in the figure) and is advanced in the insertion space **216**, a top surface of the band **230** contacts the engagement claw **221** of the operation plate **220** and advances raising one edge section of the operation plate **222** (in the side where the engagement claw **221** is formed), thus a position for approach to or separation from the band **230** against the buckle **210** being adjusted. In this state, as shown in FIG. **12(a)**, the engagement claw **221** is engaged and hooked in the engagement groove **231**, so that the band **230** can move forward against the buckle **210**, but can not move backward.

On the other hand, to move the band **230** backward against the buckle **210** or pull of the band **230** from the buckle **210**, the pressed section **222** of the operation plate **220** is slightly depressed with a finger tip. Then, as shown in FIG. **12(b)**, the operation plate **220** turns around the joint shaft **225**, so that the engagement claw **221** positioned in the opposite side is raised and the engagement claw **221** is unhooked from the engagement groove **231**, and in this state the band **230** can free be slid. When the finger is removed from the depressed section **222**, the depressed section **222** restores its original horizontal position because of elasticity of the synthetic resin.

Next another embodiment of the present invention is described with reference to the perspective view shown in FIG. **13**. In FIG. **13**, the same reference numerals are assigned to the same components as those shown in FIG. **10**, and description thereof is omitted herefrom.

In this embodiment, an upper rim section of the operation plate **220** and an upper section of the ceiling frame **212** are jointed to each other at the position of the joint shaft **225** by joint pieces **227**, **227**, and the operation plate **220** can be swung around the joint pieces **227**, **227** as fulcrums. It is to be noted that the reference numeral. **228** indicates a lacked groove formed in the joint pieces **227**, **227** in the swinging direction to insure accurate swinging of the operation plate **220**.

In this embodiment, one edge section of the operation plate **220** (in the side where the engagement claw **221** is provided) is jointed to the opposite ceiling frame **212**. This joint is realized with joint members **233**, **233** each extending from a corner of the operation plate **220**, and after the pressed section **222** is depressed and then the finger tip is removed from the pressed section, the operation plate **220**

can easily restore its original horizontal position. Therefore, any form such as a waved plate other than that described above may be employed as a form of the joint member **233**. In other words, the joint member **233** functions as a damper against swinging operations of the operation plate **220**. Further, a side rim section of the operation plate **220** other than the one edge section thereof may be jointed to the ceiling frame **212** on the condition that the operation plate **220** and the ceiling frame **212** are positioned in the opposite side of the depressed section **222** around the joint shaft **225** (or a joint piece **227**). For that purpose, it is desirable to locate a stopper **240** at the one edge section of the operation plate **220** so that the one edge section is contacted to and raised by the ceiling frame **212** to an unnecessarily high position. In the embodiment shown in FIG. **14**, the bottom plate **211** is formed into a curved surface along the head section, leg section, body section or other section on which the bottom plate **211** is to be placed.

Next a variant of the buckle **210** according to still another embodiment of the present invention is described with reference to FIGS. **15(a)** and **15(b)**.

In this embodiment, a hooking protrusion **235A** is provided on the ceiling frame **212** in the protruding state. By simultaneously hooking finger tips on the hooking protrusion **235A** and the hooking protrusion **235B** provided on an outer surface of the band **230** as shown in FIG. **12(a)**, the band **230** can be pulled closer to the buckle **210** with one hand. Therefore, the hooking protrusions **235A** and **235B** are required only to have the size enough for a finger tip to be hooked thereon, and there is no restriction over the form.

A reinforcing rib **236** is provided at a central position of the top surface of the operation plate **220** in the longitudinal direction to insure swinging operations of the operation plate **220**. The rib **236** may be provided at a position other than the central position of the top surface of the operation plate **220**, for instance, along the upper rim of the operation plate **220** in the longitudinal direction, or on a rear (bottom) surface of the operation plate **220**.

Stoppers **237** for preventing the other edge section (in the side where the pressed section **222** is provided) from being depressed to an unnecessarily low level are provided in the insertion space **216** in the buckle body **214**. In this embodiment, the stoppers **237** are provided under the edge section and protrude from each of the two side plates **213**, **213**.

Further provided inside the insertion space **216** are band holders **238**, **238** for preventing the band **230** from being raised. If the band **230** is raised, the engagement groove **231** of the band **230** is raised when the engagement claw **221** is disengaged from the engagement groove **231**, which makes it impossible to disengage the engagement claw **221** from the engagement groove **231**. In this embodiment, the band holders **238** are provided just below the engagement claw **221** in the protruding state from the two side plates **213**, **213**.

The number of components in the buckle according to the present invention is small, and the buckle is made from synthetic resin, so that the weight is small and the production cost is low. Further, the engagement claw is directly operated by the wearer, so that the wearer can accurately engage or disengage the buckle. In addition, as the operation plate is surrounded by the ceiling frame, the buckle is never unlocked carelessly or unexpectedly. Further, the operation plate is provided in parallel to the bottom plate, so that a form of the buckle is very flat and compact. Especially, when this buckle is used for a head band for a helmet, even if the buckle is present at a rear section of the wearer's head, the

band size can easily be adjusted by unlocking the buckle. Because of the features as described above, the buckle of a head band for a helmet according to the present invention is best suited to use in various works including construction works, civil engineering works, or when the wearer is driving a car or sporting.

The buckle according to the present invention is fabricated by casting, and as the die used for casting has a simple structure, cost of the die is low, and fabrication of the buckle is very easy.

The buckle having a joint shaft jointing the two intermediate points of the side plates insure swinging operations of the operation plate provided in the horizontal position, and in addition the buckle is structurally very solid and can endure reciprocal operations of the operation plate for a long time.

The buckle, in which a section near one edge section of the operation plate is jointed. to at least one edge of the ceiling frame opposite to the operation pale, enables the operation plate to easily restore the original position, which further insures accurate operations for engagement or disengagement with improvement reliability.

What is claimed is:

1. A band comprising:

one edge section having engagement grooves, and the other edge section having an engagement claw, said band being set into a circular form by sliding the two edge sections over each other to adjust the length and engaging one of the engagement grooves with the engagement claw at a desired position,

wherein a resilient piece having the engagement claw is provided substantially in parallel to the other edge section, the one edge section can move freely to the other edge section and can not move backward when the engagement claw is engaged in one of the engagement grooves, the engagement claw can be disengaged from the one of the engagement grooves by pressing the resilient piece, the resilient piece is made from a

material harder than a material used for the two edge sections, and the resilient piece is covered with a hood expanding to an outer periphery side at the other edge section of the band.

2. The band according to claim 1, wherein a pair of hooking sections, making it possible to pull the two edge sections closer to each other with finger tips of one hand, is provided at outer surfaces of the two edge sections.

3. The band according to claim 1, further comprising band holders provided along upper and lower rims of an outer surface of the other edge section.

4. A buckle made from synthetic resin and having a buckle body comprising a bottom plate, a ceiling frame opposite to the bottom plate and two side plates connecting the bottom plate to the ceiling frame, and including a space for insertion of a band with engagement grooves, and an operation plate provided inside the ceiling frame in a horizontal position and having an engagement claw engageable in the engagement grooves on a bottom surface of one edge section thereof and a top surface of the other edge section used as a pressing section, wherein said operation plate is jointed to opposite two edges of the ceiling frame at intermediate points between the engagement claw and the pressing section so that the operation plate can freely swing around the intermediate points as a fulcrum, and a portion near the other edge section of said operation plate is jointed to at least one edge of the ceiling frame opposite to the operation plate.

5. The synthetic resin buckle according claim 4, wherein said buckle is fabricated by casting.

6. The synthetic resin buckle according to claim 4, wherein said ceiling frame and said operation plate are jointed to each other with a joint shaft connecting the intermediate points.

7. The synthetic resin buckle according to claim 4, wherein a pair of hooking protrusions, making it possible to pull the band closer to the buckle body with finger tips of one hand, is provided on an outer surface of the band as well as on the ceiling frame.

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