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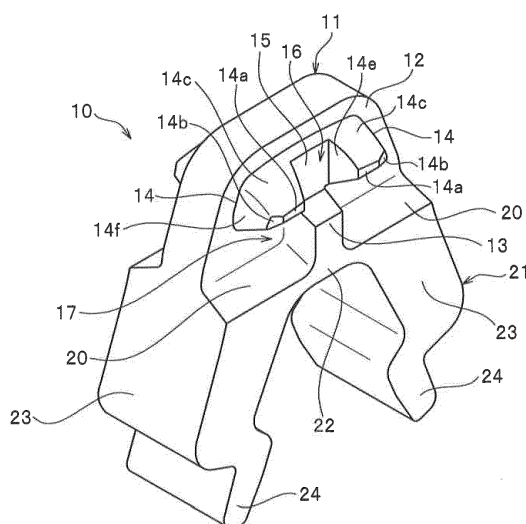
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(54) **FASTENER ELEMENT AND FASTENER STRINGER**

(57) Provided is a metallic fastener element including a coupling head portion (11) and a tape holding portion (21), in which the coupling head portion (11) includes a flat plate portion (12), a central projecting portion (13) projecting from an upper surface and a lower surface of the flat plate portion (12), and a right and left pair of coupling convex portions (14), and the right and left coupling convex portions (14) are disposed on an inner side in the element width direction to be apart from right and left

outer side edges on the upper surface and the lower surface of the flat plate portion (12). Thereby, a fastener element (10) of a slide fastener (1) has an appearance like "Japanese kokeshi doll" and can have gloss and color which cannot be obtained by die-casting. Further, when the slide fastener (1) is bent into a U-shape in a coupling state of the fastener elements (10), an occurrence of coupling cracks can be prevented. (150 words)

FIG.1



Description

Technical Field

[0001] The invention relates to a metallic fastener element for a slide fastener.

Background Art

[0002] A metallic fastener element is known as one of the fastener elements for slide fasteners. The metallic fastener element includes several kinds. As one of the typical type of the metallic fastener element, for example, it is known that molten metal such as zinc alloy is poured into a molding die which holds a fastener tape to form a fastener element at a tape side part of the fastener tape using a die-casting.

[0003] The metallic fastener element formed by using such a die-casting generally has a shape as shown in Fig. 13. Specifically, metallic fastener elements 72 of a slide fastener 70 as shown in Fig. 13 are fixed across top and back surfaces of the fastener tape 71. Each fastener element 72 has a symmetrical shape in a tape top and back direction (upper and lower direction) with respect to a center position in the tape top and back direction of the fastener tapes 71.

[0004] The fastener element 72 has a body portion fixed to the fastener tape 71, a neck portion extending from the body portion, and a coupling head portion extending further from the neck portion. In this case, in a plan view of the slide fastener 70, the body portion of the fastener element 72 is formed to have a substantially rectangular shape. The neck portion of the fastener element 72 is formed so as to have a constricted shape in a plan view such that a dimension in an element width direction (tape length direction) (hereinafter referred to as an element width) is smaller than the body portion. The coupling head portion is formed to have a substantially elliptical shape in a plan view. Therefore, each fastener element 72 has a shape (appearance) like "Japanese kokeshi doll" (or "matryoshka") in a plan view of the slide fastener 70.

[0005] As another typical type of the metallic fastener element, it is known that a thin plate-shaped flat rectangular member made of metal such as copper alloy is punched out using a punch to form a fastener element. An example of the fastener element formed by punching out such a flat rectangular member is described in International Publication No. 2010/089854 (Patent Document 1), for example.

[0006] The metallic fastener element described in Patent Document 1 has a form, so-called double-sided element. Specifically, the fastener element of Patent Document 1 has a coupling head portion provided with a symmetrical shape in a tape top and back direction (upper and lower direction) and a tape holding portion extending toward an element length direction from one end of the coupling head portion.

[0007] The coupling head portion of the fastener element has a flat plate portion formed thinner than the tape holding portion via a step portion. On an upper surface and a lower surface of the flat plate portion, coupling convex portions protruding in an upper and lower direction from the flat plate portion and right and left raised portions rising from the flat plate portion in the upper and lower direction and extending rightward and leftward of the coupling convex portions from the tape holding portion are respectively provided. The tape holding portion of the fastener element has a connecting portion connected to the coupling head portion and a right and left pair of leg portions branching and extending from the connecting portion.

[0008] In such a fastener element of Patent Document 1, it is possible that each fastener element is charged into a treatment container after being punched out from the flat rectangular member, and polishing treatment is performed to the fastener element in the container. Thereby, it is possible to apply gloss to the fastener element. It is also possible to color the fastener element by performing a treatment of painting a desired color to the fastener element in the container. Furthermore, it is also possible to improve corrosion resistance of the fastener element by performing a treatment of applying clear coating.

[0009] The fastener element subjected to the surface treatment such as a polishing treatment is supplied to a tape side edge part of the fastener tape in a predetermined posture. Then, in a state that the tape side edge part of the fastener tape is inserted between the right and left leg portions of the fastener element, the right and left leg portions are pressed inward. Thereby, the fastener elements are attached one by one to the tape side edge parts of the fastener tapes to form a fastener stringer for a slide fastener.

[0010] As described above, a shape of the fastener element in a plan view of the slide fastener manufactured by attaching the fastener elements to the fastener tape is completely different from the shape of the fastener element in the plan view which is formed using a die-casting as above, for example.

[0011] Meanwhile, in the Chinese Utility Model Publication No. 200959886 (Patent Document 2), for example, as shown in Fig. 14, a fastener element 80 which is formed by punching a metallic flat rectangular member and which has a shape like "Japanese kokeshi doll" in a plan view when attached to a fastener tape is disclosed.

[0012] The fastener element 80 is also formed as a so-called double-sided element, and includes a coupling head portion 81 provided with a symmetrical shape in a tape top and back direction (upper and lower direction) and a tape holding portion 82 extending in an element length direction from one end of the coupling head portion 81.

[0013] The coupling head portion 81 has a flat plate portion 84 which is formed thinner than the tape holding portion 82 via a step portion 83. On an upper surface and

a lower surface of the flat plate portion 84, a central projecting portion 85 which is protruded in a center part in an element width direction and is connected to the tape holding portion 82, and a right and left pair of the coupling convex portions 86 which are protruded in front of the central projecting portion 85 are respectively provided.

[0014] In such a slide fastener having the fastener element 80 of Patent Document 2, each fastener element 80 can have an appearance similar to the fastener element which is formed by die-casting, that is a shape like "Japanese kokeshi doll".

Prior Art Documents

Patent Documents

[0015]

Patent Document 1: WO 2010/089854 A

Patent Document 2: CN 200959886 Y

Summary of Invention

Problems to be Solved by the Invention

[0016] A slide fastener is manufactured by attaching the aforementioned fastener elements 80 of Patent Document 2 having the appearance like "Japanese kokeshi doll" to a fastener tape. In this case, when the slide fastener is bent in a substantially U-shape in a tape length direction such that tape top surface side parts (or tape back surface side parts) of the fastener elements 80 which are adjacent in the tape length direction come close to each other in a state that the right and left fastener elements 80 are coupled, problems has occurred such as coupling cracks (also referred to as chain cracks) in that the coupling of the right and left fastener elements 80 are disengaged.

[0017] Therefore, an object of the present invention is to provide a fastener element having an appearance like "Japanese kokeshi doll" in a plan view of the slide fastener similar to the fastener element formed by die-casting, being able to be surface-treated such as polishing treatment, and further less likely causing coupling cracks even when the slide fastener is bent into a substantially U-shape in the tape length direction in a state that the right and left fastener elements are coupled, and a fastener stringer provided with the fastener elements.

Means for Solving the Problems

[0018] In order to achieve the above object, the fastener element provided by the present invention, as one of the main characteristics, is a metallic fastener element including a coupling head portion and a tape holding portion extending rearward in an element length direction from one end of the coupling head portion, in which the coupling head portion includes a flat plate portion formed

to be thinner than the tape holding portion via a step portion, a central projecting portion protruded on a center part in an element width direction on each of an upper surface and a lower surface of the flat plate portion, and a right and left pair of coupling convex portions protruded in front of the central projecting portions on each of the upper surface and the lower surface of the flat plate portion, an insertion groove portion is provided between the right and left coupling convex portions, and right and left insertion concave portions are provided on both right and left sides of the central projecting portion and between the right and left coupling convex portions and the tape holding portion, being characterized in that the right and left coupling convex portions are disposed on an inner side in the element width direction to be apart from right and left outer side edges on each of the upper surface and the lower surface of the flat plate portion.

[0019] In such a fastener element of the present invention, it is preferable that in each top end part of the right and left coupling convex portions, an outer side end part disposed on an outer side in the element width direction and an inner side end part disposed on an inner side adjacent to the insertion groove portion have an asymmetrical shape, and the outer side end part of the top end part includes a slope portion which decreases a height dimension of the coupling convex portion from the flat plate portion toward an outside in the element width direction.

[0020] In this case, it is preferable that when the right and left coupling convex portions are viewed from the front, a corner portion is disposed between a top end edge and an inner side edge of the coupling convex portion, and the slope portion of the outer side end part is disposed between the top end edge and an outer side edge of the coupling convex portion to be sloped downward toward the outer side edge and to have a size of 10% or more of a minimum width dimension between the inner side edge and the outer side edge of the coupling convex portion in the element width direction.

[0021] In the fastener element of the present invention, it is preferable that the coupling head portion includes a raised portion disposed between the right and left coupling convex portions and rising from each of the upper surface and the lower surface of the flat plate portion, and the raised portion is connected to the central projecting portion and the right and left coupling convex portions.

[0022] Further, it is preferable that the tape holding portion includes a holding base end portion connecting to the coupling head portion, right and left leg portions branching to be extended from the holding base end portion, and right and left fin portions bending inward from a tip end part of each leg portion and extending rearward, the right and left fin portions respectively include an inner side surface facing to each other and an outer side surface disposed on an opposite side of the inner side surface, and the inner side surface of the fin portion is oblique with respect to the outer side surface of the fin portion

such that a dimension between the inner side surface and the outer side surface gradually decreases toward a tip end of the fin portion.

[0023] In this case, it is preferable that the outer side surface of the fin portion is disposed parallel to an outer side surface of the leg portion. It is further preferable that an oblique angle of the inner side surface with respect to the outer side surface in the fin portion is set to be 2° or larger and 15° or smaller.

[0024] According to the present invention, a fastener stringer being characterized in that a plurality of the fastener elements having the above configuration is attached to a tape side edge part of a fastener tape is provided.

[0025] In this case, it is preferable that the step portions of the fastener element are sloped such that outer side portions of the right and left step portions are disposed behind inner side portions of the step portion.

Effects of the Invention

[0026] The fastener element of the present invention has a coupling head portion and a tape holding portion in an integrated manner. The coupling head portion has a thin plate-shaped flat plate portion provided with a flat upper surface and lower surface, a central projecting portion projecting from both upper surface and lower surface of the flat plate portion, and a right and left pair of coupling convex portions protruded on a position in front of the central projecting portions on the both upper surface and lower surface of the flat plate portion. On an upper surface and a lower surface of the coupling head portion, an insertion groove portion disposed between the right and left coupling convex portions, and right and left insertion concave portions disposed on both right and left sides of the central projecting portion and disposed between the right and left coupling convex portions and the tape holding portion are respectively provided.

[0027] In the present invention, the right and left coupling convex portions protruded respectively on the upper surface and the lower surface of the flat plate portion are disposed on an inner side in an element width direction and at a position apart from right and left outer side edges of the flat plate portion on the upper surface and the lower surface. Thereby, on an outer side of the right and left coupling convex portions in the element width direction, a flat upper surface or a lower surface of the flat plate portion is disposed to be exposed.

[0028] When the fastener tapes to which the fastener elements of the present invention having such a configuration are attached are viewed from a tape top surface side (or a tape back surface side), a side surface of the thin flat plate portion of the coupling head portion, side surfaces of the coupling convex portions protruded symmetrically on the upper surface and the lower surface of the flat plate portion, and a side surface of the tape holding portion formed to be thick from one end part of the flat plate portion via the step portions are seen. Therefore,

the fastener element of the present invention has a shape (appearance) similar to the fastener element formed by using the above-mentioned die-casting, for example.

[0029] Further, such a fastener element of the present invention can be stably manufactured by performing a punching process to punch out a thin plate-shaped flat rectangular member made of metal such as copper alloy using a punch, as described later. In the fastener element of the present invention manufactured by punching out the flat rectangular member in this manner, it is possible to optionally perform a surface treatment such as polishing treatment or painting treatment before attaching the fastener elements to the fastener tape.

[0030] Furthermore, in the fastener element of the present invention, the right and left coupling convex portions protruded on the upper surface and the lower surface in the flat plate portion are disposed on the inner side in the element width direction and at the position apart from the right and left outer side edges of the flat plate portion on the upper surface and the lower surface, thereby the following effects can be obtained.

[0031] Here, in the slide fastener having the conventional fastener element 80 of Patent Document 2, when the slide fastener is bent into a substantially U-shape in the tape length direction in a state that the right and left fastener elements 80 are coupled, coupling cracks are likely to occur as described above. The inventors of the present invention researched and determined the cause of the occurrence of the coupling cracks, and considered the countermeasure. As a result, they reached the present invention.

[0032] Specifically, in a case of the above-mentioned fastener element 80 of Patent Document 2, as shown in Fig. 14, the right and left pair of coupling convex portions 86 are respectively provided on the upper surface and the lower surface of the flat plate portion 84 in the coupling head portion 81. These coupling convex portions 86 are disposed along outer side edges of an element width direction in the flat plate portion 84. Further, outer side surface of each coupling convex portion 86 is formed to be continuous from right and left side end surfaces of the flat plate portion 84. Thereby, a top end surface of each coupling convex portion 86 is also disposed so as to extend from a center position in the element width direction of the fastener element 80 to a position outward away.

[0033] When the slide fastener having such a fastener element 80 of Patent Document 2 is bent into a substantially U-shape in the tape length direction in a state that the right and left fastener elements 80 are coupled, the top end part of the coupling convex portion 86 positioned on an inner peripheral side (concave side) of the fastener element 80 likely to come in contact with the flat plate portion 84 of the fastener element 80 on the coupling counterpart side. Therefore, the slide fastener tends to become rigid and hardly bend into a U-shape, which lowers the flexibility.

[0034] As a result, an interval between the coupling convex portion 86 positioned on an outer peripheral side

(convex side) and the flat plate portion 84 of the fastener element 80 on the coupling counterpart side widely expands with the contact position as a fulcrum. Then, the right and left fastener elements 80 are not able to maintain the coupling state, and a coupling crack tends to occur in that the right and left fastener elements 80 are disengaged (Note that the mechanism of occurrence of the coupling crack will be described in detail with reference to Fig. 12 also in the following embodiments).

[0035] Therefore, in the fastener element of the present invention, the right and left coupling convex portions are disposed on the inner side to be apart from the right and left outer side edges of the flat plate portion on the upper surface and the lower surface, and the upper surface and the lower surface of the flat plate portion are provided between the right and left outer side edges of the flat plate portion and the right and left coupling convex portions. Thereby, a top end surface of the coupling convex portion of the present invention is disposed at an inner position in the element width direction compared to the conventional ones. Therefore, even when the slide fastener manufactured by using the fastener elements of the present invention is bent into a substantially U-shape in a state that the right and left fastener elements are coupled, the coupling convex portion positioned on an inner peripheral side (concave side) of each fastener element can hardly come in contact with the flat plate portion of the fastener element on the coupling counterpart side compared to the conventional cases.

[0036] As a result, the state that the interval between the coupling convex portion positioned on the outer peripheral side (convex side) and the flat plate portion of the fastener element on the coupling counterpart side tends to be large with the contact position (interference position) as a fulcrum as in the conventional Patent Document 2 is unlikely to occur. Therefore, the slide fastener having the fastener elements of the present invention can be bent to a radius of curvature smaller than that of the conventional ones. Further, even when it is bent to a smaller radius of curvature, the coupling crack is unlikely to occur, and the coupling state of the right and left fastener elements can be stably maintained.

[0037] In a manufacturing step for manufacturing the fastener element of the present invention by punching out a metallic flat rectangular member, a press mold processing is performed to form the right and left coupling convex portions and the central projecting portion by performing a press molding with a molding punch (press punch) on the flat rectangular member from an upper side and a lower side. Thereafter, a punching processing is performed on the flat rectangular member which has been press-molded.

[0038] In this case, the right and left coupling convex portions are disposed on the inner side to be apart from the right and left outer side edges of the flat plate portion as in the fastener element of the present invention, thereby the strength of the punch used in the punching processing is enhanced, as described later. Therefore,

even though the punching processing by the punch is repeatedly performed, breakage of the punch hardly occurs, and the life of the punch can be prolonged. As a result, frequency of replacement of the punch can be decreased as compared to the conventional cases, and the manufacturing cost can be reduced.

[0039] Further in the present invention, the right and left coupling convex portions in the coupling head portion are provided on the inner side and at a position to be apart from the right and left outer side edges of the flat plate portion, and the upper surface and the lower surface of the flat plate portion are remained on the outside of the coupling convex portion so as to be exposed. Thereby, it is possible to secure the strength of the fastener element properly and to prevent the touch of the fastener element from being worsened.

[0040] In such a fastener element of the present invention, each top end part of the right and left coupling convex portions has a shape in that an outer side end part disposed on an outer side in the element width direction and an inner side end part disposed on an inner side which is adjacent to the insertion groove portion is asymmetric. In addition, the outer side end part of the top end part in each coupling convex portion has a slope portion (slope surface) which gradually decreases a height dimension of the coupling convex portion from the flat plate portion toward the outer side in the element width direction.

[0041] Particularly in this case, when the right and left coupling convex portions are viewed from the front, a corner portion is disposed between a top end edge and an inner side edge of the coupling convex portion. The slope portion disposed at the outer side end part of the coupling convex portion is formed between the top end edge and the outer side edge of the coupling convex portion so as to slope downward toward the outer side edge, and has a size of 10% or larger of a minimum width dimension between the inner side edge and the outer side edge of the coupling convex portion in the element width direction.

[0042] The fastener element of the present invention having the coupling convex portion of the above-mentioned configuration is able to have a shape like "Japanese kokeshi doll" stably in a plan view of the slide fastener. Since the corner portion is provided at the inner side end part of the coupling convex portion, when the central projecting portion of the fastener element on the coupling counterpart side is inserted between the right and left coupling convex portions, the inserting state of the central projecting portion can be stably maintained. Therefore, the slide fastener to be manufactured can stably ensure high coupling strength. It should be noted that the corner portion of the coupling convex portion refers to a part where the upper surface and the inner side surface of the coupling convex portion cross with each other and the corner portion is formed to be an angular shape. However, the corner portion may be formed to be slightly curved because it is manufactured by press molding.

[0043] In addition, since the slope portion is provided

at the outer side end part of the coupling convex portion as described above, the coupling convex portion of each fastener element is less likely to come in contact with the flat plate portion of the fastener element on the coupling counter side when the slide fastener is bent in a substantially U-shape in a state that the fastener elements are coupled with each other. Thereby, the coupling cracks can be less likely to occur.

[0044] In the fastener element of the present invention, the coupling head portion has a raised portion disposed between the right and left coupling convex portions and raised from the upper surface and the lower surface of the flat plate portion, respectively. The raised portion is connected to the central projecting portion and the right and left coupling convex portions. Thereby, strength of the right and left coupling convex portions and the strength of the central projecting portion can be enhanced effectively. As a result, the coupling strength of the slide fastener to be manufactured can be stably maintained over the long term.

[0045] Further, since the coupling head portion has the aforementioned raised portion, the flow amount of metal due to the pressing can be suppressed to a smaller amount when performing a press molding with a molding punch in manufacturing of a fastener element. Thereby, the load that the molding punch receives at the time of the press molding can be reduced. At the same time, moldability of the press molding with the molding punch is enhanced, and the coupling convex portions and the central projecting portion having a predetermined shape can be stably molded, so that occurrence of molding defects can be reduced.

[0046] Further in the present invention, the tape holding portion has a holding base end portion connected to the coupling head portion, right and left leg portions branching from the holding base end portion and extending rearward, and right and left fin portions bending inward from a tip end part of each leg portion and further extending rearward. Since the fastener element of the present invention has the right and left pair of fin portions as above, the fastener tape can be held by the right and left leg portions and the right and left fin portions of the fastener element. Therefore, attaching strength of the fastener element can be enhanced. In addition, when the slide fastener is formed using the fastener element of the present invention, the fin portions of the fastener element can prevent the slider (particularly upper and lower flange portions of the slider) from directly sliding and contacting with the fastener tape. Therefore, even when the slider is repeatedly slid, the fastener tape is less likely to be damaged, and the durability of the slide fastener (in particular, the fastener tape) can be improved.

[0047] Further in this case, the right and left fin portions of the fastener element respectively have inner side surfaces facing to each other and outer side surfaces disposed on opposite sides of the inner side surfaces. The outer side surface of the fin portion is disposed parallel to the outer side surface of the leg portion. On the other

hand, the inner side surface of the fin portion is oblique to the outer side surface of the fin portion such that a dimension between the inner side surface and the outer side surface gradually decreases toward a tip end of the fin portion. In particular, the oblique angle of the inner side surface with respect to the outer side surface in the fin portion is preferably set to be 2° or larger and 15° or smaller.

[0048] The inner side surface of the fin portion is disposed to be oblique with respect to the outer side surface. Thereby, although the base end part of the inner peripheral surface in the fin portion is contacted with the fastener tape so as to be firmly pressed, a tip end part of the inner peripheral surface in the fin portion is not pressed as strongly as the base end part, thereby, it is fixed to the fastener tape less firmly than the base end part. In other words, the pair of fin portions disposed in the fastener element is attached such that the force for holding the fastener tape from tape top and back surfaces is gradually weakened from the base end part to the tip end part of the inner peripheral surface.

[0049] Thereby, it is possible to suppress the loss of the flexibility of the fastener tape due to the fact that the right and left fin portions of the fastener element strongly hold the fastener tape, and to ensure the flexibility of the fastener stringer properly when the slide fastener is formed.

[0050] Subsequently, according to the present invention, a fastener stringer is provided in which a plurality of fastener elements having the above-mentioned configuration are attached to the tape side edge part of the fastener tape. In a case of the fastener stringer of the present invention having the above-described fastener elements, when the slide fastener is manufactured, each of the fastener elements has a shape like "Japanese kokeshi doll" in a plan view of the slide fastener. Further, even when the slide fastener is bent in a substantially U-shape in the tape length direction in a state that the right and left fastener elements are coupled, coupling cracks are unlikely to occur, and the coupling state of the right and left fastener elements can be stably maintained.

[0051] Furthermore, in the present invention, surface treatments such as polishing treatment, painting treatment, and plating treatment can be easily performed to the fastener element before the fastener elements are attached to the fastener tape. Therefore, in the fastener stringer of the present invention, gloss and various colors can be applied to the fastener element as compared to the fastener stringer in which the fastener elements are formed using, for example, die-casting. In addition, corrosion resistance of the fastener element can be improved. As a result, the quality of the slide fastener can be improved, and variety of the slide fastener that can be provided to the market can be easily increased.

[0052] In such a fastener stringer of the present invention, the step portions formed between the coupling head portion and the tape holding portion of each fastener element are sloped such that outer side portions of the

right and left step portions are disposed to be rear compared to inner side portions of the step portions. Thereby, when the slide fastener is formed and the right and left element rows are coupled, the coupling convex portions of each fastener element can be less likely to interfere with the tape holding portion of the fastener element on the coupling counterpart side. As a result, the flexibility of the slide fastener (fastener chain) in a coupled state can be properly and stably ensured.

Brief Description of Drawings

[0053]

Fig. 1 is a perspective view of a fastener element according to an embodiment of the present invention.

Fig. 2 is a plan view when the fastener element is viewed from an element upper side.

Fig. 3 is a side view when the fastener element is viewed from an element side side.

Fig. 4 is a front view when the fastener element is viewed from an element front side.

Fig. 5 is an enlarged view of a coupling convex portion of the fastener element enlarged.

Fig. 6 is an explanatory view schematically explaining a step of manufacturing the fastener element of the embodiment from a metallic flat rectangular member.

Fig. 7 is a perspective view of a part of a punch used in manufacturing the fastener element.

Fig. 8 is a perspective view illustrating a part of a punch of a comparative example.

Fig. 9 is a partial cross-sectional view illustrating a state that the fastener element of the embodiment is attached to a fastener tape.

Fig. 10 is a plan view of a slide fastener having the fastener element of the embodiment when it is viewed from a tape top surface side.

Fig. 11 is a cross-sectional view of a position of the line XI-XI shown in Fig. 10 when the slide fastener of the embodiment is bent in a U-shape in a tape length direction.

Fig. 12 is a cross-sectional view of the slide fastener of the comparative example when it is bent in a U-shape.

Fig. 13 is a plan view illustrating a slide fastener having conventional metallic fastener elements formed using die-casting.

Fig. 14 is a perspective view illustrating a fastener element described in Patent Document 2.

Modes for Conducting the Invention

[0054] Hereinafter, favorable modes for conducting the invention will be described in detail showing an embodiment with reference to the drawings. It should be noted that the present invention is not limited to the embodi-

ments explained as below, and various changes can be made as long as having a substantially same structure and similar functional effects to the present invention.

[0055] The fastener element of the following embodiment is, for example, manufactured by punching a metallic flat rectangular wire member into a predetermined element shape. However, in the fastener element of the present invention, metallic fastener elements are also included in which, for example, a long wire member having a Y-shaped cross section is sequentially cut to produce Y-shaped elements, and a part corresponding to the coupling head portion of the obtained element material is locally press-deformed.

Embodiment

[0056] Fig. 1 is a perspective view illustrating a fastener element according to the present embodiment before attached to a fastener tape. Figs. 2, 3 and 4 are a plan view, a side view and a front view of the fastener element, respectively.

[0057] In the following description regarding the fastener element, an element height direction or an element upper and lower direction means a direction which is to be a tape length direction when the fastener element is attached to the fastener tape. An element width direction or an element right and left direction means a direction which is to be a tape top and back direction when the fastener element is attached to the fastener tape.

[0058] An element length direction or an element front and rear direction means a direction which is to be a tape width direction when the fastener element is attached to the fastener tape. In particular, the front in the element length direction refers to a direction oriented to the coupling head portion from the tape holding portion of the fastener element, and the rear in the element length direction refers to the opposite direction.

[0059] The fastener element 10 of the present embodiment shown in Figs. 1 to 4 is press molded using a molding punch (not shown) with respect to a flat rectangular wire member 30 made of metal such as copper alloy, nickel alloy, or aluminum alloy, as described later, and thereafter the flat rectangular wire member subjected to the press molding is punched into a predetermined element shape using a punch 40 (also referred to as a blanking punch) described later.

[0060] The fastener element 10 of the present embodiment has a coupling head portion 11 in which a central projecting portion 13 and right and left coupling convex portions 14 are protruded on both of an upper surface and a lower surface of a flat plate portion 12, and a tape holding portion 21 extending from one end part (rear end part) of the coupling head portion 11 via a step portion 20. The fastener element 10 is formed as so-called double-sided element in which the right and left pair of coupling convex portions 14 are respectively disposed on an upper surface side and a lower surface side of the coupling head portion 11.

[0061] Particularly, in the fastener element 10 of the present embodiment, the coupling head portion 11 is formed to be symmetrical in an upper and lower direction with respect to a center position in an element height direction. Therefore, regarding the central projecting portion 13, the coupling convex portions 14, and a raised portion 15 described later, in the coupling head portion 11 on the upper surface side of the fastener element 10 will be mainly described in order to avoid redundant explanation. Regarding the central projecting portion 13, the coupling convex portions 14, and the raised portion 15 disposed on the lower surface side of the fastener element 10, the description is omitted by showing the same references.

[0062] The coupling head portion 11 of the fastener element 10 has the thin plate-shaped flat plate portion 12 disposed at a center part in the upper and lower direction, the central projecting portion 13 and the right and left pair of coupling convex portions 14 protruded respectively on the upper surface and the lower surface of the flat plate portion 12, and the raised portion 15 disposed between the right and left pair of the coupling convex portions 14. In the coupling head portion 11, an insertion groove portion 16 disposed between the right and left coupling convex portions 14, and right and left insertion concave portions 17 disposed on both right and left sides of the central projecting portion 13 and between the coupling convex portions 14 and the tape holding portion 21 are formed.

[0063] The flat plate portion 12 of the coupling head portion 11 is provided with the upper surface, the lower surface, and a side surface connecting the upper surface and the lower surface. A thickness (height dimension) of the flat plate portion 12 is smaller than a thickness (height dimension) of the tape holding portion 21. The upper surface and the lower surface of the flat plate portion 12 is formed to be a flat surface orthogonal to the element height direction. Thereby, a dimension (thickness dimension) of the flat plate portion 12 in the element height direction is set to be a predetermined constant size for the entire flat plate portion 12.

[0064] Right and left side edges of the flat plate portion 12 are, when viewed from the element upper and lower direction, formed to be oblique with respect to an element length direction such that a dimension (width dimension) in an element width direction gradually decreases toward a tip end part (front end part) of the coupling head portion 11 from a base end part connecting to the tape holding portion 21.

[0065] Particularly, in the fastener element 10 of the present embodiment, the flat upper surface of the flat plate portion 12 is disposed on a front side and a rear side of the right and left coupling convex portions 14, and also disposed on an outer side of the coupling convex portions 14 in the element width direction. Further, a side edge to be a boundary (ridge line part) is disposed between the upper surface of the flat plate portion 12 and the side surface of the flat plate portion 12. The side edge

of the flat plate portion 12 and the base end part of the coupling convex portion 14 are separated completely by the upper surface of the flat plate portion 12.

[0066] The central projecting portion 13 of the coupling head portion 11 is raised from the upper surface of the flat plate portion 12. The central projecting portion 13 is formed at a center part in the element width direction as a rectangle having a substantially rectangular shape along the element length direction. The central projecting portion 13 is connected to the tape holding portion 21. An upper surface of the central projecting portion 13 is formed to be a single flat surface continuing to an upper surface of the tape holding portion 21. In this case, the upper surface of the central projecting portion 13 and the upper surface of the tape holding portion 21 are disposed orthogonal to the element height direction.

[0067] A front surface of the central projecting portion 13 is formed to be a slope surface sloping downward toward a tip end (front end) of the coupling head portion 11. A front end part of the central projecting portion 13 is connected to a raised portion 15 disposed between the right and left coupling convex portions 14. Right and left side surfaces of the central projecting portion 13 have flat side surfaces disposed substantially orthogonal to the element width direction. At the same time, the right and left side surfaces of the central projecting portion 13 have curved surfaces formed at a rear end part of these flat side surfaces close to the tape holding portion 21. The curved surface is formed to be curved outward in the element width direction so as to be continuous with a step surface of the step portion 20 disposed between the coupling head portion 11 and the tape holding portion 21. The step surface of the step portion 20 is also a front surface of the tape holding portion 21.

[0068] In this case, the step portion 20 between the coupling head portion 11 and the tape holding portion 21 is, in the fastener element 10 before attached to the fastener tape 3 (i.e., the fastener element 10 as shown in Fig. 1 to Fig. 4), disposed to be separated to both right and left sides of the central projecting portion 13, and is disposed along the element width direction. Further, the step surface of the step portion 20 (the front surface of the tape holding portion 21) is formed as a slope surface or a curved surface sloping downward toward the front.

[0069] The right and left coupling convex portions 14 are protruded from the flat plate portion 12 in a mound shape such that the position of a convex portion top end surface 14a of the coupling convex portion 14 is disposed to be front of the central projecting portion 13. In the present embodiment, the right and left coupling convex portions 14 are provided such that the height dimension from the flat plate portion 12 is slightly larger than that of the central projecting portion 13. That is, in a side view of the fastener element 10 shown in Fig. 3, an upper end of the coupling convex portion 14 is higher than at least the central projecting portion 13. That is, in the side view of the fastener element 10 shown in Fig. 3, the upper end of the coupling convex portion 14 is disposed higher than

at least the central projecting portion 13. In the present invention, the height dimension of the coupling convex portion 14 from the flat plate portion 12 may be set to the same size or the size slightly smaller than the height dimension of the central projecting portion 13 from the flat plate portion 12.

[0070] The right and left coupling convex portions 14 have a symmetrical shape with respect to the center position in the element width direction of the coupling head portion 11, and are disposed side by side in the element width direction. Further, the right and left coupling convex portions 14 are, in the element width direction, protruded at a position which is inwardly apart from right and left outer side edges of the upper surface on the flat plate portion 12. Therefore, on the outer side of the left coupling convex portion 14 (i.e., left side) and the outer side of the right coupling convex portion 14 (i.e., right side), the flat upper surface of the flat plate portion 12 is disposed so as to extend from a front region through a rear region of the coupling convex portion 14. Since the flat upper surfaces of the flat plate portion 12 are formed on the outer sides of the right and left coupling convex portions 14 in the element width direction as above, strength of the coupling head portion 11 in the fastener element 10 is properly secured, and touch feeling of the fastener element 10 can be prevented from being worsened.

[0071] The coupling convex portion 14 of the present embodiment has the convex portion top end surface 14a disposed at a position farthest from the upper surface (or lower surface) of the flat plate portion 12 in the upper and lower direction, a convex portion slope surface 14b disposed on the outer side of the convex portion top end surface 14a in the element width direction, a convex portion front surface 14c, a convex portion rear surface 14d and a convex portion inner side surface 14e and a convex portion outer side surface 14f disposed so as to surround the convex portion top end surface 14a and the convex portion slope surface 14b in a plan view of the coupling head portion 11.

[0072] In this case, the convex portion top end surface 14a of the coupling convex portion 14 is formed to be a flat surface disposed orthogonal to the element height direction. The convex portion slope surface 14b is formed as a slope part which is disposed between the convex portion top end surface 14a and the convex portion outer side surface 14f of the coupling convex portion 14, and sloped downward so as to gradually decrease the height dimension of the coupling convex portion 14 from the flat plate portion 12 from the convex top end surface 14a toward the outer side in the element width direction.

[0073] In particular, in the present embodiment, the convex portion slope surface 14b is formed as a flat surface sloping linearly downward at a constant rate toward the outer side. In the present invention, the convex portion slope surface 14b may be formed as a curved surface sloping downward toward the outer side and gradually increasing the slope ratio.

[0074] In the present embodiment, the convex portion

slope surface 14b is, as shown in Fig. 5, formed to have a size of its dimension W1 in the element width direction to be 10% or larger of a minimum width dimension W2 in the element width direction between the convex portion inner side surface 14e and the convex portion outer side surface 14f of the coupling convex portion 14. Thereby, the effect of preventing coupling cracks to be exerted when the slide fastener 1 is bent in a U-shape can be further enhanced, as described later.

[0075] The convex portion front surface 14c of the coupling convex portion 14 is disposed so as to slope downward to the front from a front end edge of the convex portion top end surface 14a and the convex portion slope surface 14b to the flat plate portion 12. Further, the convex portion front surface 14c is formed to be a curved surface having a slightly convex surface shape in a side view of the fastener element 10 as shown in Fig. 3.

[0076] The convex portion rear surface 14d of the coupling convex portion 14 is formed to be a flat surface so as to slope downward to the rear from a rear end edge of the convex portion top end surface 14a and the convex portion slope surface 14b to the flat plate portion 12. The convex portion inner side surface 14e is disposed so as to stand from an outer side edge part of the raised portion 15 in the element width direction, and is formed as a flat surface sloping downward toward an inner side in the element width direction from an inner side edge of the convex portion top end surface 14a to the raised portion 15.

[0077] The convex portion outer side surface 14f of the coupling convex portion 14 is disposed so as to stand from the upper surface of the flat plate portion 12, and is formed as a flat surface sloping downward toward an outer side in the element width direction from an outer side edge of the convex portion slope surface 14b to the flat plate portion 12. In the present invention, the convex portion front surface 14c, the convex portion rear surface 14d, the convex portion inner side surface 14e, and the convex portion outer side surface 14f of the coupling convex portion 14 may be formed as a flat surface sloping to the element height direction, or as a curved surface curving in a convex shape outward.

[0078] In the right and left coupling convex portions 14 of the present embodiment, the convex portion slope surface 14b is provided on the outside of the convex portion top end surface 14a as above. Therefore, in a front view when the fastener element 10 is seen from the front as shown in Fig. 4 and Fig. 5, a downward slope part formed as the convex portion slope surface 14b sloping downward toward an outer side edge is disposed between a top end edge formed as the convex portion top end surface 14a of the coupling convex portion 14 and the outer side edge formed as the convex portion outer side surface 14f.

[0079] Further, in a front view of the fastener element 10, a corner portion 14g having a obtusely square shape is disposed between the top end edge formed as the convex portion top end surface 14a and the inner side

edge formed as the convex portion inner side surface 14e of the coupling convex portion 14. In this case, the obtuse angle of the corner portion 14g means an angle (inner angle) of the corner portion 14g from a part of the convex portion top end surface 14a (straight line part) to a part of the convex portion inner side surface 14e (straight line part) as shown in Fig. 5 with an arrow when the fastener element 10 is viewed from the front. In the present invention, a chamfered corner portion having a curved shape with a small radius of curvature may be disposed between the top end edge and the inner side edge of the coupling convex portion 14 in a front view.

[0080] That is, the top end part of the coupling convex portion 14 of the present embodiment has, in a front view of the fastener element 10, an outer side end part disposed on an outer side in the element width direction and provided with the downward slope portion as the convex portion slope surface 14b, and an inner side end part disposed on an inner side in the element width direction adjacently to the insertion groove portion 16 and provided with the square corner portion 14g. Therefore, in the front view of the fastener element 10, the top end part of the coupling convex portion 14 has a shape such that the outer side end part and the inner side end part are asymmetrical to each other in the element width direction.

[0081] The raised portion 15 of the coupling head portion 11 is disposed at a center part in the element width direction of the flat plate portion 12 and on the front of the central projecting portion 13 so as to be interposed by the right and left coupling convex portions 14. The raised portion 15 is formed to be raised from the upper surface of the flat plate portion 12, and an upper surface of the raised portion 15 is disposed to be in parallel with the upper surface of the flat plate portion 12. A front end part of the raised portion 15 has a front surface sloping downward toward the front, and the front surface of the raised portion 15 is formed continuously with the convex portion front surface 14c of the right and left coupling convex portions 14.

[0082] A rear end part of the raised portion 15 is connected to the central projecting portion 13. Right and left side edge parts of the raised portion 15 are respectively connected to the right and left coupling convex portions 14. The central projecting portion 13 and the right and left coupling convex portions 14 are reinforced by such a raised portion 15. As a result, coupling strength of the slide fastener 1 can be improved.

[0083] Moreover, the raised portion 15 is formed between the right and left coupling convex portions 14, thereby in the manufacturing step of punching out the fastener element 10 from a flat metallic rectangular member, as described later, the flow amount of flow of metal due to pressing can be suppressed to be low.

[0084] In the present embodiment, a height dimension of the raised portion 15 from the flat plate portion 12 is set to be 5% or larger and 50% or smaller, and preferably 10% or larger and 40% or smaller of the height dimension of the coupling convex portion 14 from the flat plate por-

tion 12. The height dimension of the raised portion 15 is set to be 5% or larger of the height dimension of the coupling convex portion 14, thereby strength of the central projecting portion 13 and the right and left coupling convex portions 14 can be enhanced effectively. Further, the height dimension of the raised portion 15 is set to be 50% or smaller of the height dimension of the coupling convex portion 14, thereby when the slide fastener 1 is formed and the right and left fastener elements 10 are coupled, the central projecting portion 13 of the fastener element 10 on the coupling counterpart side can be stably inserted into the insertion groove portion 16 without interfering with the raised portion 15, as described later.

[0085] The insertion groove portion 16 provided between the right and left coupling convex portions 14 of the coupling head portion 11 is disposed above the raised portion 15. The insertion groove portion 16 serves as a space part into which the central projecting portion 13 of the fastener element 10 on the coupling counterpart side is inserted when the slide fastener 1 is formed and the right and left fastener elements 10 are coupled.

[0086] The right and left insertion concave portions 17 provided on both right and left sides of the central projecting portions 13 in the coupling head portion 11 are disposed to be surrounded by the coupling convex portion 14, the central projecting portion 13, and the tape holding portion 21. Further, the right and left insertion concave portions 17 are formed such that an opposite side to the central projecting portion 13, i.e., outer sides in a width direction of the insertion concave portion 17, is opened. In other words, a bottom surface of the insertion concave portion 17 is continuous with the flat upper surface of the flat plate portion 12 as the same flat surface. These insertion concave portions 17 serve as space parts into which the coupling convex portions 14 of the fastener element 10 on the coupling counterpart side are respectively inserted, when forming the slide fastener 1 and coupling the right and left fastener elements 10.

[0087] In the present embodiment, since the raised portion 15 is provided in the coupling head portion 11, the height dimension of the space part serving as the insertion groove portion 16 is smaller than the height dimension of the space part serving as the right and left insertion concave portions 17. The height dimension of the space part serving as the insertion groove portion 16 is the dimension from the height position of the convex portion top end surface 14a of the coupling convex portion 14 to the height dimension of the upper surface of the raised portion 15. The height dimension of the space part serving as the insertion concave portion 17 is the dimension from the height position of the upper surface of the central projecting portion 13 to the height position of the upper surface of the flat plate portion 12.

[0088] In the coupling head portion 11 of the present embodiment, the minimum dimension of the insertion groove portion 16 in the element width direction is set to be equal to or larger than the dimension in the element width direction of the upper surface in the central project-

ing portion 13, and preferably equal to or larger than the maximum dimension in the element width direction of the central projecting portion 13. The minimum dimension in the element width direction of the insertion groove portion 16 is the dimension in the element width direction of the upper surface of the raised portion 15. In this case, the maximum dimension in the element width direction of each of the right and left coupling convex portions 14 is set larger than the maximum dimension in the element width direction of the central projecting portion 13.

[0089] Furthermore, the dimension in the element width direction from the convex portion outer side surface 14f of the left coupling convex portion 14 to the convex portion outer side surface 14f of the right coupling convex portion 14 is set to be in a range of 50% to 95%, and preferably 60% to 90% with respect to the dimension in the element width direction of the flat plate portion 12 at the corresponding position in an element length direction (i.e., the dimension in the element width direction from the left outer side edge to the right outer side edge of the flat plate portion 12.) The ratio is set at 50% or more, thereby strength of the right and left coupling convex portions 14 can be secured, and the slide fastener 1 can be stably provided with proper coupling strength. The ratio is set at 95% or less, thereby it is possible to stably form the flat upper surface and the lower surface of the flat plate portion 12 on the outsides of the right and left coupling convex portions 14.

[0090] The tape holding portion 21 of the fastener element 10 has a holding base end portion 22 connecting to the coupling head portion 11, a right and left pair of leg portions 23 branching from the holding base end portion 22 toward right and left and extending rearward, and a right and left fin portions 24 bending inward from a rear end part (tip end part) of each leg portion 23 and further extending rearward.

[0091] An upper surface and a lower surface of the tape holding portion 21 are formed as flat surfaces orthogonal to the element height direction. Therefore, a dimension in the element height direction (height direction) between the upper surface and the lower surface of the tape holding portion 21 is set to be a constant size as a whole. In the present invention, it is also possible to provide a convex portion for prevention of sticking with which the fastener element described in the above-mentioned Patent Document 1 is provided.

[0092] The holding base end portion 22 of the tape holding portion 21 connects the coupling head portion 11 with the right and left leg portions 23. A height dimension of the holding base end portion 22 is set to be larger than a height dimension of the flat plate portion 12 of the coupling head portion 11. Further, an upper surface of the holding base end portion 22 is disposed to be continuous so as to form a single flat surface from the upper surface of the central projecting portion 13.

[0093] The right and left leg portions 23 are formed symmetrically with respect to the center position of the fastener element 10 in the element width direction. In a

state before the fastener element 10 is attached to the fastener tape 3, the right and left leg portions 23 extend from the holding base end portion 22 to a direction oblique outward with respect to the element length direction such that an interval in the element width direction between the right and left leg portions 23 gradually increases rearward. In this case, right and left side surfaces of the flat plate portion 12 in the coupling head portion 11, right and left side surfaces of the holding base end portion 22, and outer side surfaces of the right and left leg portions 23 are continuously disposed to form a single flat surface.

[0094] The right and left fin portions 24 extend inward from an inner side surface of a tip end part in the right and left leg portions 23, and further extend to be bent in substantially the same direction as the extending direction of the leg portions 23. Further, the right and left fin portions 24 respectively have an inner side surface disposed to face each other and an outer side surface disposed opposite to the inner side surface. In this case, the outer side surface of the fin portion 24 is disposed parallel to the outer side surface of the leg portion 23.

[0095] The inner side surface of the fin portion 24 is disposed obliquely so that a dimension between the inner side surface and the outer side surface gradually decreases toward a tip end of the fin portion 24. In this case, particularly, oblique angle θ of the inner side surface with respect to the outer side surface in the fin portion 24 is set to be 2° or larger and 15° or smaller.

[0096] The oblique angle θ is set at 2° or larger, thereby effect securing flexibility of the fastener stringer 2 properly and effect securing a swing of the fastener element 10 with respect to the fastener tape 3, as described later, can be stably obtained. Further, the above oblique angle θ is set at 15° or smaller, thereby strength of fin portion 24 can be stably secured. In the present invention, the fastener element 10 may be formed without providing the right and left fin portions 24.

[0097] Next, a method of manufacturing the fastener element 10 of the present embodiment as above will be described.

[0098] First, a flat rectangular wire member 30 made of metal is prepared (see Fig. 6). At this time, a flat rectangular wire member 30 having a thickness dimension equal to the height dimension of the tape holding portion 21 in the fastener element 10 is prepared.

[0099] Subsequently, the prepared flat rectangular wire member 30 is carried into a press molding step, and the flat rectangular wire member 30 is press molded using an upper and lower pair of molding punches (not shown). At this time, in the molding punch used for press molding, a press portion (not shown) for pressing the flat rectangular wire member 30 locally to be plastically deformed is provided at a tip end part. The press portion of the molding punch has a shape corresponding to the concave-convex shape of the coupling head portion 11 so that the shape of the coupling head portion 11 of the fastener element 10 described above can be molded with respect to a top surface and a back surface of the flat

rectangular wire member 30.

[0100] Specifically, in the press portion of the molding punch, a right and left pair of first concave portions for molding a shape of the right and left coupling convex portions 14 of the fastener element 10, a second concave portion for molding a shape of the central projecting portion 13 of the fastener element 10, and a third concave portion for molding a shape of the raised portion 15 of the fastener element 10 are concaved at a predetermined position and shape corresponding to a position and shape of each portion of the fastener element 10.

[0101] In the present embodiment, press molding is performed to the flat rectangular wire member 30 using such a molding punch, thereby the shape of the coupling head portion 11 is molded to the top surface and the back surface of the flat rectangular wire member 30 at a predetermined pitch in the length direction of the flat rectangular wire member 30 as shown in Fig. 6. At this time, the coupling head portion 11 has the above-mentioned raised portion 15, thereby it is possible to suppress the flow amount of metal in the flat rectangular wire member 30 due to the pressing to be small, compared with a case that the raised portion 15 is not provided, for example. Thus, the load on the molding punch at the time of press molding can be decreased. Moreover, the moldability of press molding is improved, and the coupling convex portions 14 and the central projecting portion 13 having a predetermined shape can be stably molded.

[0102] Subsequently, a part of the flat rectangular wire member 30 in which the coupling head portion 11 is molded is carried into a punching step, and a punching processing is performed to a predetermined portion of the flat rectangular wire member 30 in which the shape of the coupling head portion 11 is molded using a punch 40 having a predetermined shape as shown in Fig. 7.

[0103] The punch 40 used in the present embodiment has a punch tip end portion 41 which is strongly in contact with a predetermined portion of the flat rectangular wire member 30 to perform a shearing processing. The punch tip end portion 41 is formed such that an outer shape of a punch tip end surface when viewed from the below has the same shape as the outer shape of the fastener element 10 in a plan view of the fastener element 10.

[0104] The punch tip end portion 41 has a head portion-side punching portion 42a contacting with the part of the flat rectangular wire member 30 which is to be the coupling head portion 11 and a holding portion punching portion 42b contacting with the part of the flat rectangular wire member 30 which is to be the tape holding portion 21. Further, a step portion corresponding to the step portion 20 of the fastener element 10 is provided between the head portion-side punching portion 42a and the holding portion punching portion 42b.

[0105] In this case, in the head portion-side punching portion 42a of the punch tip end portion 41, a right and left pair of first concave portions 43 in which a part to be the right and left coupling convex portions 14 in the fastener element 10 is accommodated, a second concave

portion 44 in which a part to be the central projecting portion 13 of the fastener element 10 is accommodated, and a third concave portion 45 in which a part to be the raised portion 15 of the fastener element 10 is accommodated, are provided in a predetermined position and shape corresponding to the position and shape of each portion of the fastener element 10.

[0106] In this case, in the coupling head portion 11 of the fastener element 10 in the present embodiment, the upper surface (or lower surface) of the flat plate portion 12 is provided on the front, right and left outer sides, and the rear of the right and left coupling convex portions 14. Therefore, in the punch 40 shown in Fig. 7, a flat surface 48 is continuously disposed so as to surround the front, the right and left outer sides, and the rear of the right and left first concave portions 43. The flat surface 48 is, when punching process is performed to the flat rectangular wire member 30 with the punch 40, the surface which contacts with a part to be the upper surface of the flat plate portion 12 in the flat rectangular wire member 30.

[0107] Here, for comparison, a case that a fastener element in which right and left convex portions are disposed to be extended to right and left outer side edges of the flat plate portion, and an upper surface and a lower surface of the flat plate portion are not provided at outer sides in an element width direction of the right and left coupling convex portions is manufactured by punching out of the flat rectangular wire member, for example, will be described. It should be noted that the fastener element according to the comparative example has the similar configuration as the fastener element 10 of the present embodiment except that an upper surface and a lower surface of a flat plate portion are not formed on an outside of the right and left coupling convex portions.

[0108] A punch (blanking punch) 50 used for manufacturing such a fastener element of a comparative example has a head portion-side punching portion 52a and a holding punching portion 52b, as shown in Fig. 8. Further, in the head portion-side punching portion 52a, a right and left pair of first concave portions 53 accommodating the coupling convex portions 14, a second concave portion 54 accommodating the central projecting portion 13, and a third concave portion 55 accommodating the raised portion 15 are concaved.

[0109] In the punch 50 of the comparative example as shown in Fig. 8, the upper surface of the flat plate portion is not formed on the right and left outer sides of the coupling convex portion, thereby, the right and left first concave portions 53 are concaved continuously to the right and left side surfaces of a punch tip end portion 51 along the width direction. Therefore, a flat surface 58 of the punch tip end portion 51 which contacts with a part to be the upper surface of the flat plate portion is disposed separately on the front side and the rear side of the first concave portions 53, and is not formed to be a continuous surface surrounding the first concave portions 53 as the punch 40 in Fig. 7. As a result, the flat surface 58 on the front side which is disposed to be in front of the first con-

cave portions 53 is formed to be elongated in the width direction, therefore strength of an elongated front end part 56 provided with the flat surface 58 on the front side becomes weak.

[0110] Thus, in a case that press molding is repeatedly performed to the flat rectangular wire member 30 using the punch 50 as shown in Fig. 8, the aforementioned elongated front end part 56 of the punch 50 receives large load. Therefore, cracks are likely to occur in a part of an imaginary line 59 as shown in Fig. 8, for example, which causes breakage such as chipping of the front end part 56. As a result, since the punch 50 needs to be replaced frequently, the manufacturing step of the fastener element becomes complicated and the burden on the manufacturing cost of the fastener element also becomes large.

[0111] On the other hand, in the punch 40 used in the present embodiment as shown in Fig. 7, the flat surface 48 is continuously disposed so as to surround the first concave portions 43. Thereby, the front end part 46 disposed in front of the first concave portions 43 in the punch tip end portion 41 and side edge parts 47 disposed on the right and left outer sides of the first concave portions 43 are connected to be reinforced with each other so that the flat surface 48 is continuous, which enhances their respective strengths. Therefore, even though the punching process is repeatedly performed to the flat rectangular wire member 30 using the punch 40 as shown in Fig. 7, breakage of the front end part 46 or the side edge parts 47 disposed on the head portion-side punching portion 42a of the punch tip end portion 41 is less likely to occur. As a result, since the replacement frequency of the punch 40 can be reduced, the manufacturing step of the fastener element 10 can be streamlined and the manufacturing cost can be reduced.

[0112] By performing a punching processing to a predetermined portion of the flat rectangular wire member 30 having been press molded using the punch 40 as described above, the fastener element 10 as shown in Figs. 1 to 4 is formed.

[0113] Furthermore, a plurality of fastener elements 10 formed of the flat rectangular wire member 30 is put into a treatment container (barrel), for example, to get polished, thereby, a gloss can be applied to the fastener elements 10. In the present embodiment, painting treatment, a plating treatment, etc. can also be performed to the plurality of formed fastener elements 10. Thereby, it is possible to enhance appearance quality of the fastener element 10 by applying a desired color to the fastener element 10, and to improve corrosion resistance of the fastener element 10.

[0114] The fastener element 10 of the present embodiment to which the polishing treatment and the like is applied, is inserted into a parts feeder (not shown) to adjust a posture of the fastener element 10, and thereafter, is supplied to the tape side edge part of the fastener tape 3 such that the tape side edge part is interposed between the right and left leg portions 23 of the fastener element

10 via a chute (not shown).

[0115] Then, the fastener element 10 supplied to the tape side edge part of the fastener tape 3 is attached one by one to the tape side edge part of the fastener tape 3 as shown in Fig. 9 by pressing the right and left leg portions 23 of the fastener tape 10 to be plastically deformed toward the fastener tape 3 using a pressing means (not shown).

[0116] At this time, the right and left leg portions 23 of the fastener element 10 are plastically deformed, thereby, right and left outer side surfaces of the holding base end portion 22 in the tape holding portion 21, the outer side surfaces of the right and left leg portions 23, and the outer side surfaces of the right and left fin portions 24 are disposed in parallel with the element length direction.

[0117] Further, the step portions 20 between the coupling head portion 11 and the tape holding portion 21 of the fastener element 10 are disposed obliquely with respect to the element width direction such that outer side portions 20a of the right and left step portions 20 are disposed behind inner side portions 20b. Thereby, when the slide fastener 1 is formed, and the right and left element rows 4 are coupled as shown in Fig. 10, the coupling convex portions 14 of each fastener element 10 can be less likely to interfere with the tape holding portion 21 of the fastener element 10 on the coupling counterpart side. As a result, flexibility of the slide fastener 1 in a coupling state can be secured properly and stably. Here, the outer side portion 20a and the inner side portion 20b of the step portion 20 mean the following parts, respectively. That is, in each of the right and left step portions 20 disposed respectively on a left side and a right side of the central projecting portion 13, with reference to the center part in the width direction of the left or right step portion 20, a part disposed from the center part in the width direction to the right or left outer side surface is referred to as the outer side portion 20a, and a part disposed from the center part in the width direction to the central projecting portion 13 is referred to as the inner side portion 20b.

[0118] Further, the fastener element 10 of the present embodiment has the right and left pair of fin portions 24. Thereby, when the fastener element 10 is attached to the fastener tape 3, the right and left leg portions 23 of the fastener element 10 hold the fastener tape 3 from a tape top and back direction, and the right and left fin portions 24 also hold the fastener tape 3 from the tape top and back direction. Thus, attaching strength of the fastener element 10 to the fastener tape 3 can be enhanced.

[0119] Particularly in this case, the inner side surface of the fin portion 24 is disposed obliquely in a predetermined angle with respect to the outer side surface of the fin portion 24 as mentioned above, which suppresses the loss of flexibility of the fastener stringer 2 due to that the right and left fin portions 24 of the fastener element 10 hold the fastener tape 3 too tight.

[0120] In the present embodiment, a plurality of fastener elements 10 is attached to the tape side edge part

of the faster tape 3 at a predetermined pitch as mentioned above, thereby the fastener stringer 2 in which the element row 4 is formed at the tape side edge part is formed.

[0121] Further, the two fastener stringers 2 are assembled in a right and left pair, and a slider 5 is assembled to the element rows 4 of both fastener stringers 2. Subsequently, a first stopper 6 and a second stopper 7 are attached adjacently to both end parts of the element rows 4. Thereby, the slide fastener 1 as shown in Fig.10 is manufactured.

[0122] In the slide fastener 1 of the present embodiment manufactured as above, when the slide fastener 1 is viewed from a tape top surface side (or tape back surface side) of the fastener tape 3, a side surface of the thin flat plate portion 12 of the coupling head portion 11 in each of the fastener elements 10, the convex portion outer side surfaces 14f of the coupling convex portion 14 which are symmetrically protruded on the upper surface and the lower surface of the flat plate portion 12, and the outer side surface of the tape holding portion 21 can be seen.

[0123] Thus, the appearance of each fastener element 10 of the slide fastener 1 shown in Fig. 10 has a shape like "Japanese kokeshi doll" similar to the fastener element 10 shown in Fig. 13 which is formed using, for example, die-casting.

[0124] Furthermore, in the fastener element 10 of the present embodiment, the flat upper surface and the lower surface of the flat plate portion 12 are disposed on the outer side of the right and left coupling convex portions 14 in the element width direction. Thereby, in a state that the right and left fastener elements 10 are coupled, as shown in Fig. 11, for example, the slide fastener 1 is bent into a U-shape toward the tape top surface side in the tape length direction so that the parts disposed on the tape top surface side of the fastener element 10 approach each other, it is possible to prevent the occurrence of coupling cracks and to stably bend to a radius of curvature smaller than that of the conventional ones.

[0125] For comparison, here, suppose a case that a slide fastener is manufactured using a fastener element 60 in which an upper surface and a lower surface of a flat plate portion 62 are not formed on outer sides of right and left coupling convex portions 64 in an element width direction as in the case with the aforementioned Patent Document 2. In a case of the comparative example, the right and left coupling convex portions 64 of the fastener element 60 are formed to be extended in the element width direction to right and left side edges of the flat plate portion 62. Therefore, a convex portion top end surface of the coupling convex portion 64 is also disposed from a center position in the element width direction of the fastener element 60 to an outer side position apart in the element width direction.

[0126] When the slide fastener in the comparative example having the fastener element 60 with such a shape is bent into a U-shape toward the tape top surface side in the tape length direction, as shown in Fig. 12, the top

end part of the coupling convex portion 64 in the fastener element 60 which is positioned on the inner peripheral side (concave side) when being bent tends to easily come in contact with the flat plate portion 62 of the fastener element 60 on the coupling counterpart side.

[0127] Furthermore, when the coupling convex portions 64 of the fastener element 60 come in contact and interfere with the flat plate portion 62 of the fastener element 60 on the coupling counterpart side, the interfered part serves as a fulcrum, and the right and left fastener elements 60 coupled with each other rotate in a direction away from each other. As a result, the interval between the coupling convex portion 64 positioned on the outer peripheral side (convex side) of the fastener element 60 and the flat plate portion 62 of the fastener element 60 on the coupling counterpart side extends to a large extent, thereby coupling state of the right and left fastener elements 60 cannot be maintained. For this reason, coupling cracks which the coupling of the right and left fastener elements 60 is separated occurs.

[0128] In contrast, in the slide fastener 1 of the present embodiment, the coupling convex portions 14 of the respective fastener element 10 are arranged at a predetermined dimension to be inside apart the outer side edges of the flat plate portion 12. In addition, on the outer side top end part of the coupling convex portion 14, the convex portion slope surface 14b sloping downward toward the outside is provided. Therefore, even when the slide fastener 1 is bent into a U-shape as above in a state that the right and left fastener elements 10 are coupled, as shown in Fig. 11, the coupling convex portion 14 which is positioned on an inner peripheral side (concave side) of each fastener element 10 is less likely in contact with (less likely interfered with) the flat plate portion 12 of the fastener element 10 on the coupling counterpart side as compared to the case of comparative example. As a result, the interval between the coupling convex portion 14 which is positioned on the outer peripheral side (convex side) of the fastener element 10 and the flat plate portion 12 of the fastener element 10 on the coupling counterpart side is less likely to extend as compared to the comparative example. Thus, the coupling state of the right and left fastener elements 10 can be stably maintained. Accordingly, in the slide fastener 1 of the present embodiment, it is possible to stably bend in a U-shape to a smaller radius of curvature without causing coupling cracks.

[0129] As mentioned above, the fastener element 10 of the slide fastener 1 of the present embodiment has a shape which exhibits an appearance like "Japanese kokeshi doll" similar to the appearance of the fastener element formed by die-casting. Moreover, since surface treatment such as polishing treatment etc. with respect to the fastener element 10 before being attached to the fastener tape 3, it is possible to provide gloss and color, etc. that cannot be obtained by die-casting and to improve corrosion resistance.

[0130] In addition, the slide fastener 1 of the present embodiment becomes the high-quality slide fastener 1

having excellent property in that even when it is bent into a U-shape in the tape length direction toward a small radius of curvature in a state that the right and left fastener elements 10 are coupled, the coupling cracks are unlikely to occur.

Reference Signs List

[0131]

1	Slide fastener	
2	Fastener stringer	
3	Fastener tape	
4	Element row	
5	Slider	5
6	First stopper	
7	Second stopper	
10	Fastener element	10
11	Coupling head portion	
12	Flat plate portion	
13	Central projecting portion	
14	Coupling convex portion	15
14a	Convex portion top end surface	
14b	Convex portion slope surface	
14c	Convex portion front surface	20
14d	Convex portion rear surface	
14e	Convex portion inner side surface	25
14f	Convex portion outer side surface	
14g	Corner portion	
15	Raised portion	30
16	Insertion groove portion	
17	Insertion concave portion	
20	Step portion	
20a	Outer side portion	35
20b	Inner side portion	
21	Tape holding portion	
22	Holding base end portion	
23	Leg portion	
24	Fin portion	
30	Flat rectangular wire member	40
40	Punch	
41	Punch tip end portion	
42a	Head portion-side punching portion	
42b	Holding portion punching portion	
43	First concave portion	45
44	Second concave portion	
45	Third concave portion	
46	Front end part	
47	Side edge part	
48	Flat surface	50
W1	Dimension in element width direction of convex portion slope surface	
W2	Minimum width dimension in element width direction between convex portion inner side surface and convex portion outer side surface	55
θ	Oblique angle	

Claims

1. A metallic fastener element (10) comprising a coupling head portion (11) and a tape holding portion (21) extending rearward in an element length direction from one end of the coupling head portion (11), in which the coupling head portion (11) includes a flat plate portion (12) formed to be thinner than the tape holding portion (21) via a step portion (20), a central projecting portion (13) protruded on a center part in an element width direction on each of an upper surface and a lower surface of the flat plate portion (12), and a right and left pair of coupling convex portions (14) protruded in front of the central projecting portions (13) on the upper surface and the lower surface of the flat plate portion (12), an insertion groove portion (16) is provided between the right and left coupling convex portions (14), and right and left insertion concave portions (17) are provided on both right and left sides of the central projecting portion (13) and between the right and left coupling convex portions (14) and the tape holding portion (21), being **characterized in that** the right and left coupling convex portions (14) are disposed on an inner side in the element width direction to be apart from right and left outer side edges on each of the upper surface and the lower surface of the flat plate portion (12).
2. The fastener element according to claim 1, being **characterized in that** in each top end part of the right and left coupling convex portions (14), an outer side end part disposed on an outer side in the element width direction and an inner side end part disposed on an inner side adjacent to the insertion groove portion (16) have an asymmetrical shape, and the outer side end part of the top end part includes a slope portion (14b) which decreases a height dimension of the coupling convex portion (14) from the flat plate portion (12) toward an outside in the element width direction.
3. The fastener element according to claim 2, being **characterized in that** when the right and left coupling convex portions (14) are viewed from the front, a corner portion (14g) is disposed between a top end edge and an inner side edge of the coupling convex portion (14), and the slope portion (14b) of the outer side end part is disposed between the top end edge and an outer side edge of the coupling convex portion (14) to be sloped downward toward the outer side edge and to have a size of 10% or more of a minimum width dimension between the inner side edge and the outer side edge of the coupling convex portion (14) in the element width direction.

4. The fastener element according to any one of claims 1 to 3, being **characterized in that** the coupling head portion (11) includes a raised portion (15) disposed between the right and left coupling convex portions (14) and rising from each of the upper surface and the lower surface of the flat plate portion (12), and the raised portion (15) is connected to the central projecting portion (13) and the right and left coupling convex portions (14). 5
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5. The fastener element according to any one of claims 1 to 4, being **characterized in that** the tape holding portion (21) includes a holding base end portion (22) connecting to the coupling head portion (11), right and left leg portions (23) branching to be extended from the holding base end portion (22), and right and left fin portions (24) bending inward from a tip end part of each leg portion (23) and extending rearward, the right and left fin portions (24) respectively include an inner side surface facing to each other and an outer side surface disposed on an opposite side of the inner side surface, and the inner side surface of the fin portion (24) is oblique with respect to the outer side surface of the fin portion (24) such that a dimension between the inner side surface and the outer side surface gradually decreases toward a tip end of the fin portion (24). 15
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6. The fastener element according to claim 5, being **characterized in that** the outer side surface of the fin portion (24) is disposed parallel to an outer side surface of the leg portion (23). 35

7. The fastener element according to claim 5 or 6, being **characterized in that** an oblique angle of the inner side surface with respect to the outer side surface in the fin portion (24) is set to be 2° or larger and 15° or smaller. 40

8. A fastener stringer being **characterized in that** a plurality of the fastener elements (10) according to any one of claims 1 to 7 is attached to a tape side edge part of a fastener tape (3). 45

9. The fastener stringer according to claim 8, being **characterized in that** the step portions (20) of the fastener element (10) are sloped with respect to the element width direction such that outer side portions (20a) of the right and left step portions (20) are disposed behind inner side portions (20b) of the step portions (20). 50
55

FIG.1

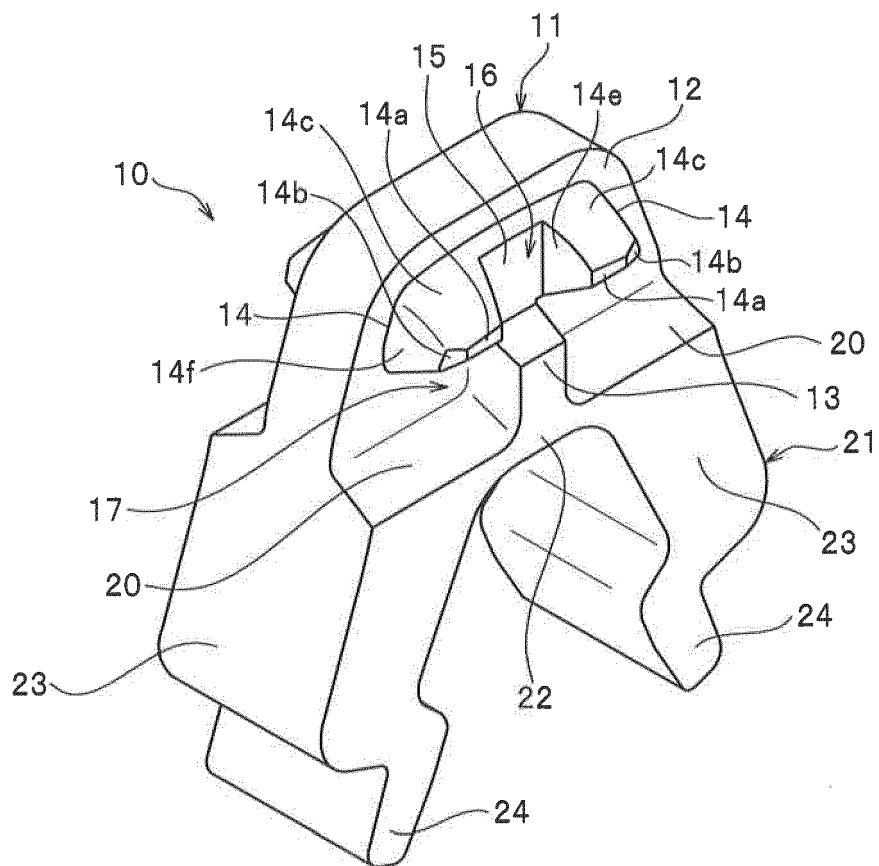


FIG.2

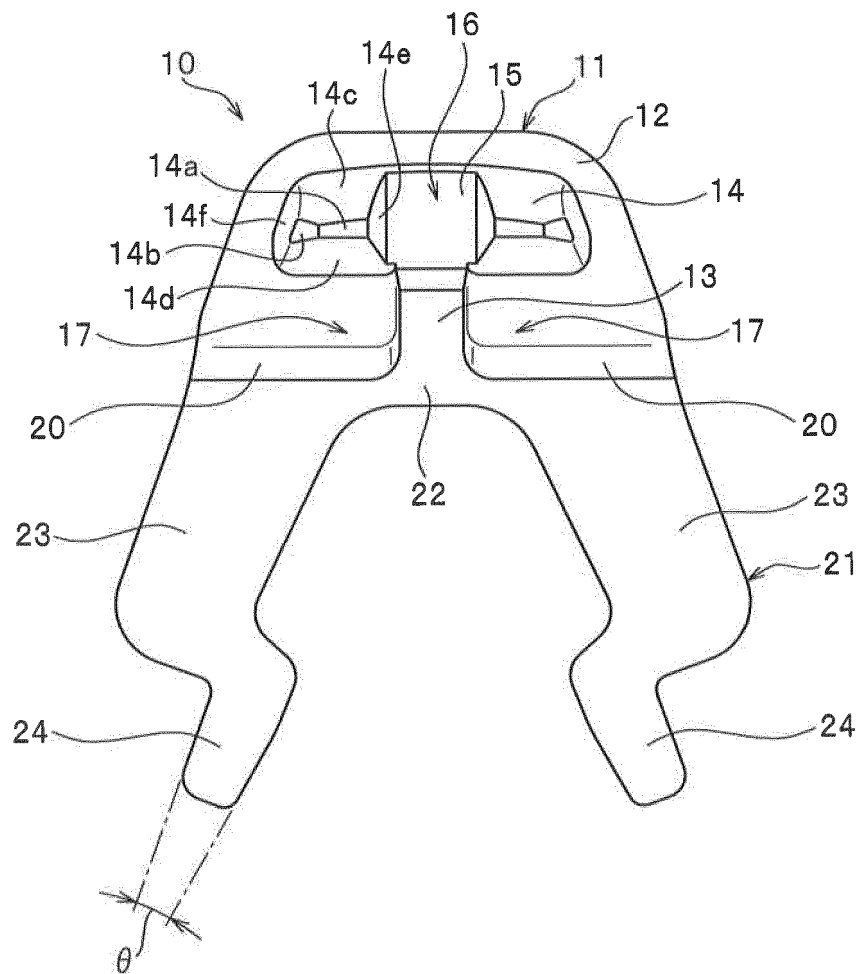


FIG.3

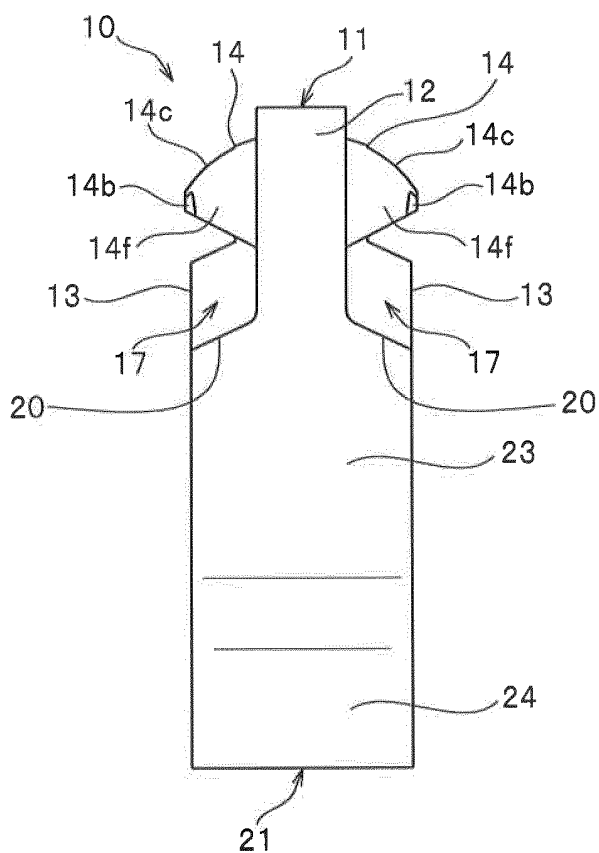


FIG.4

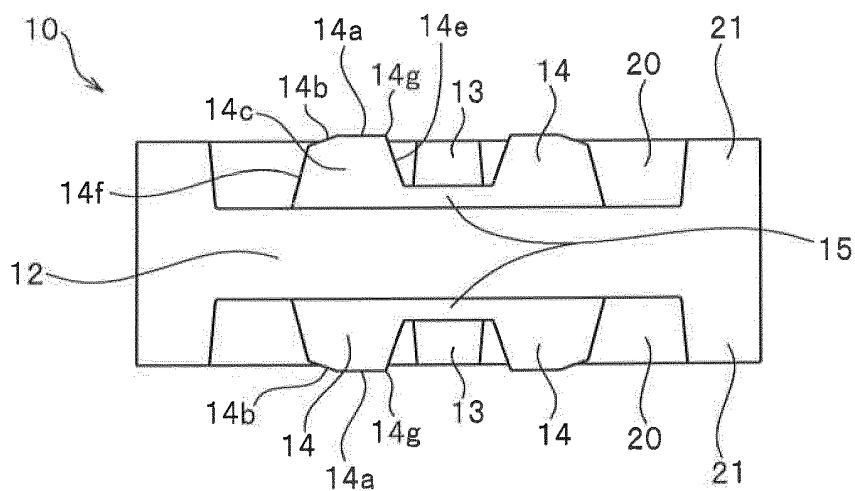


FIG.5

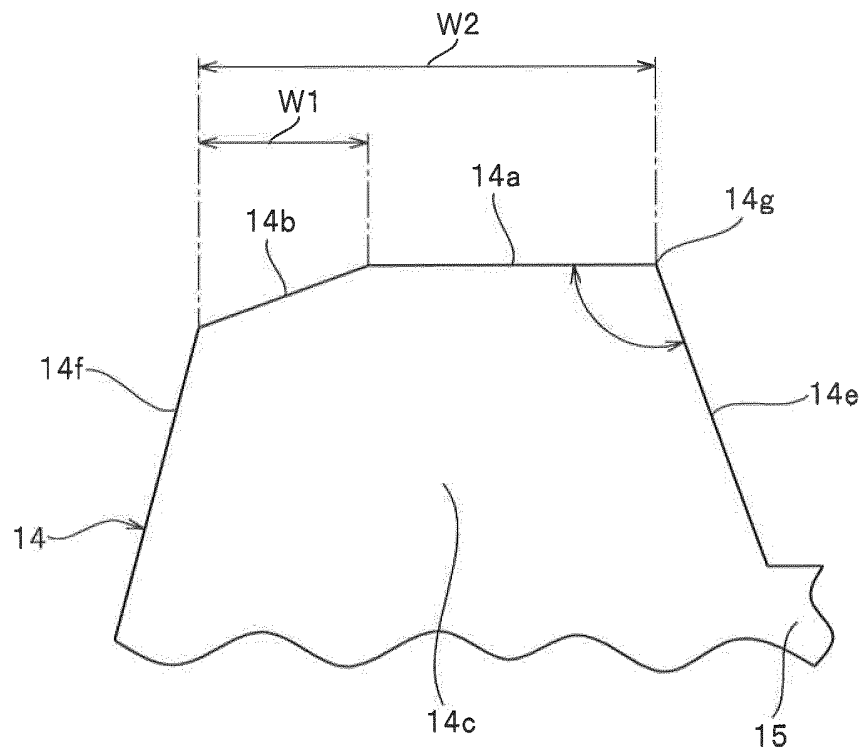


FIG.6

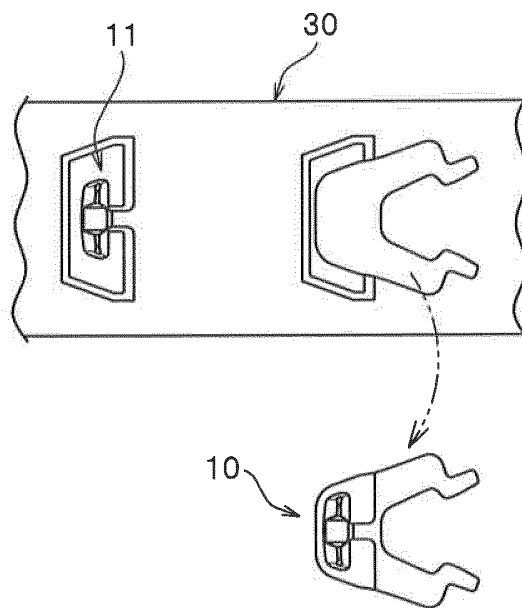


FIG.7

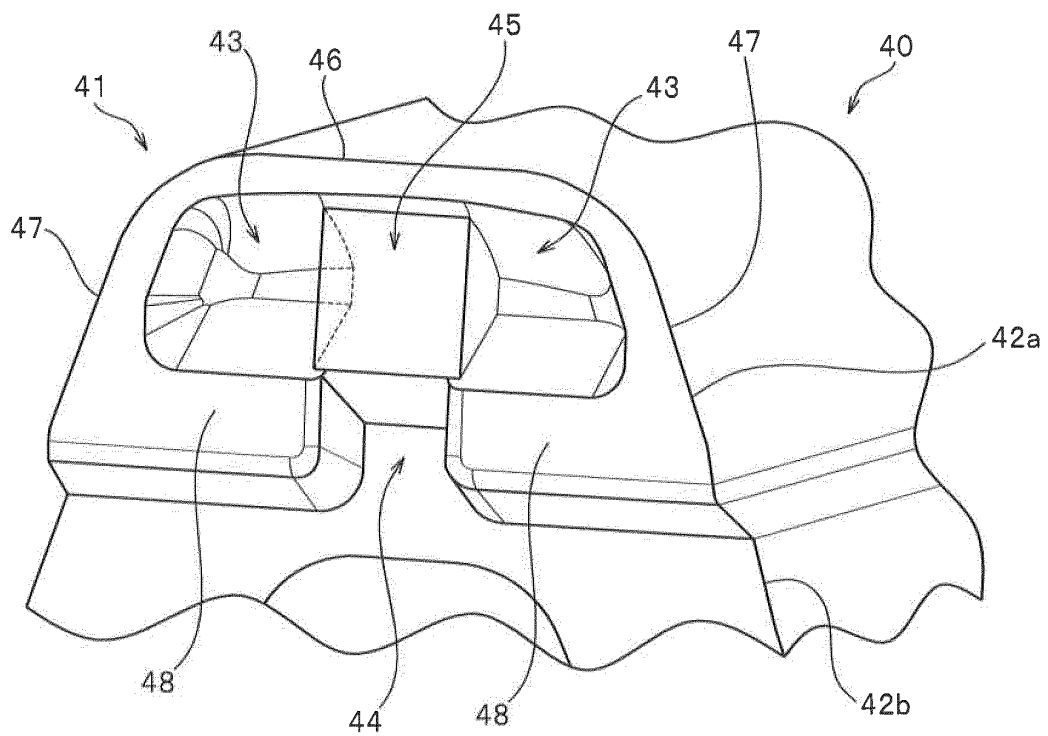


FIG.8

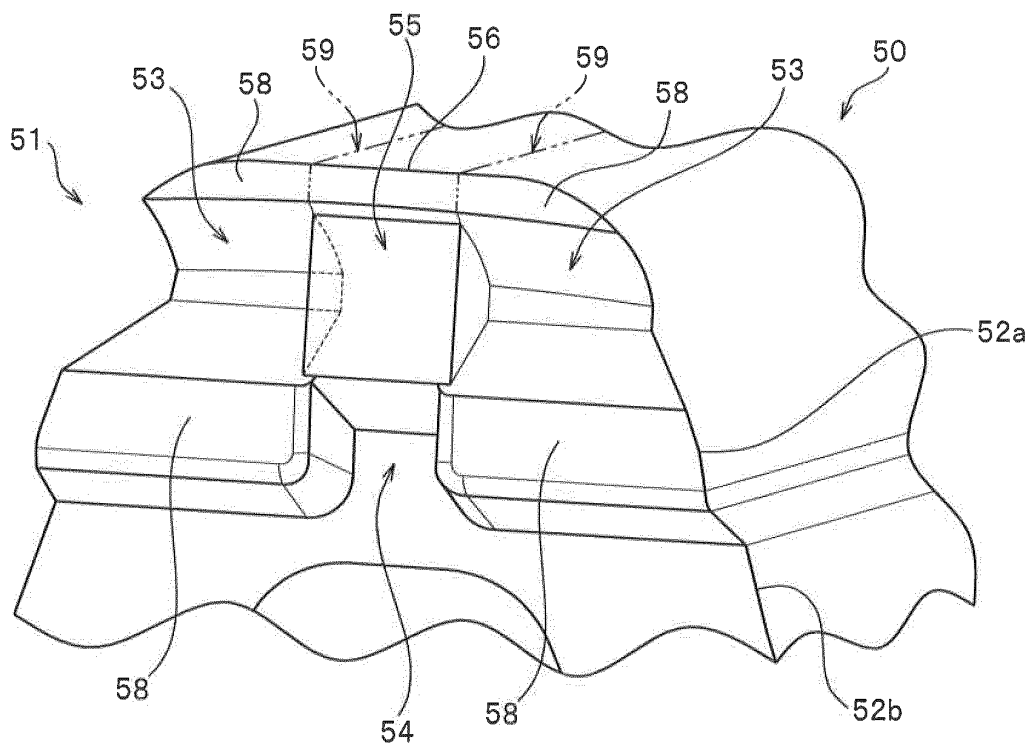


FIG.9

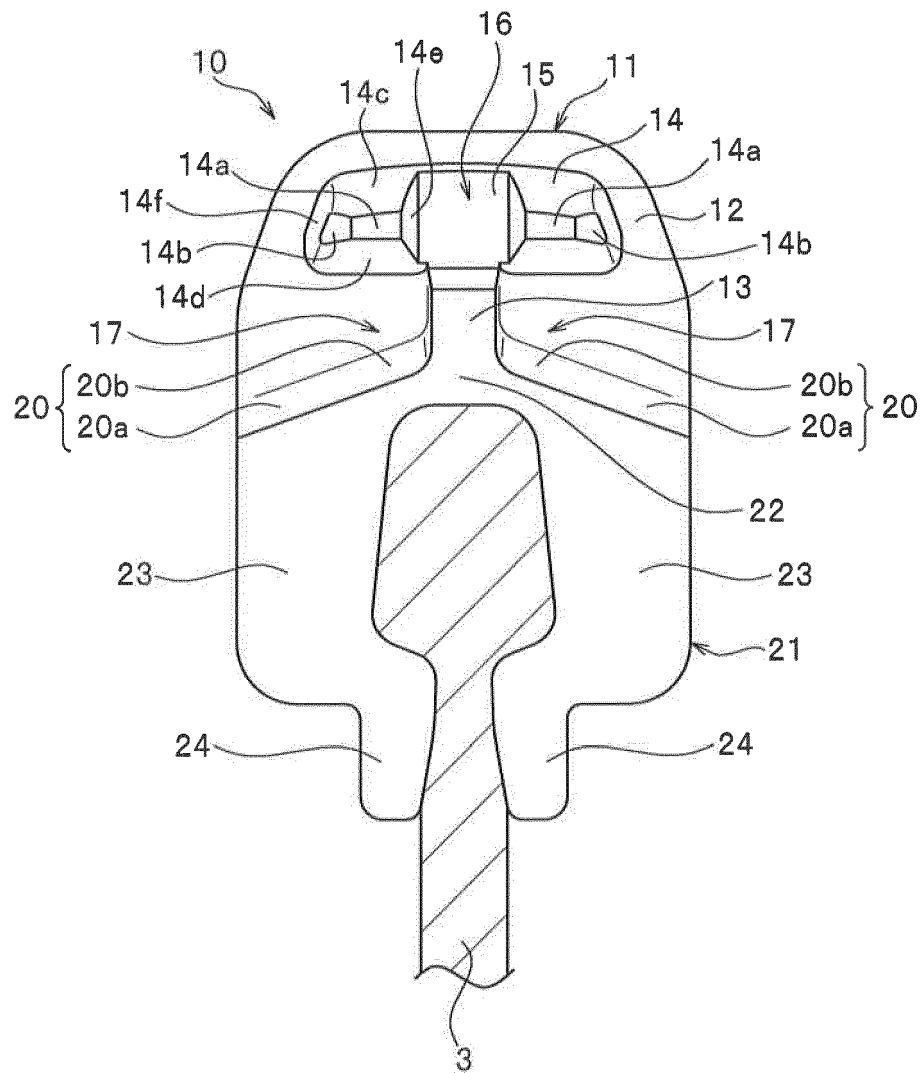


FIG. 10

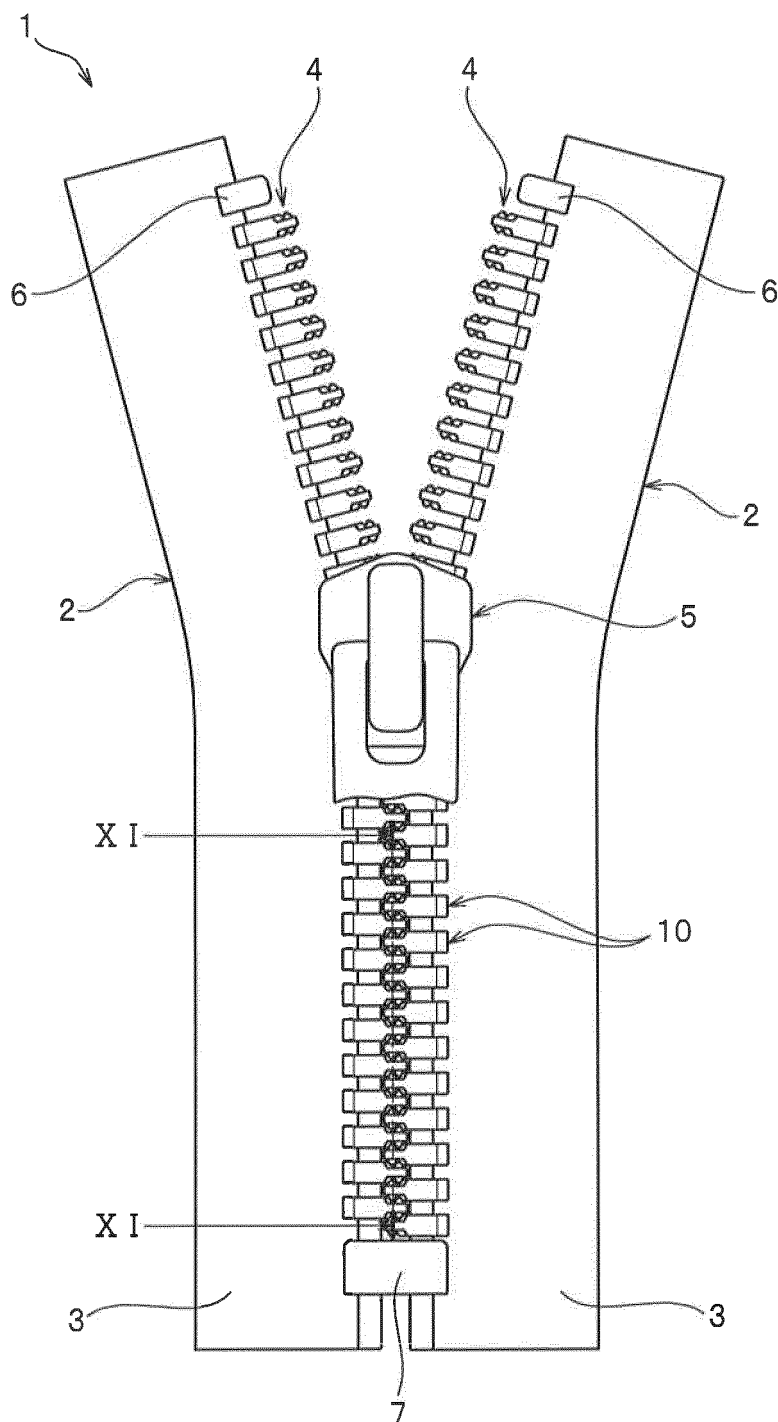


FIG.11

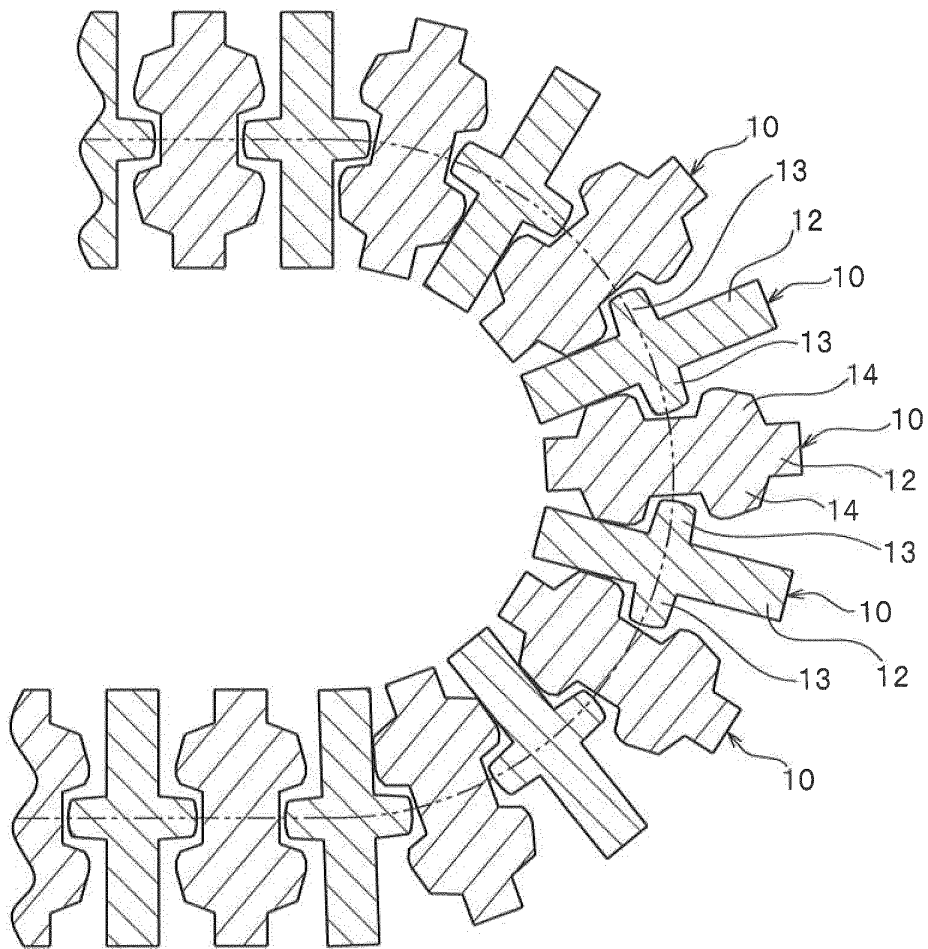


FIG.12

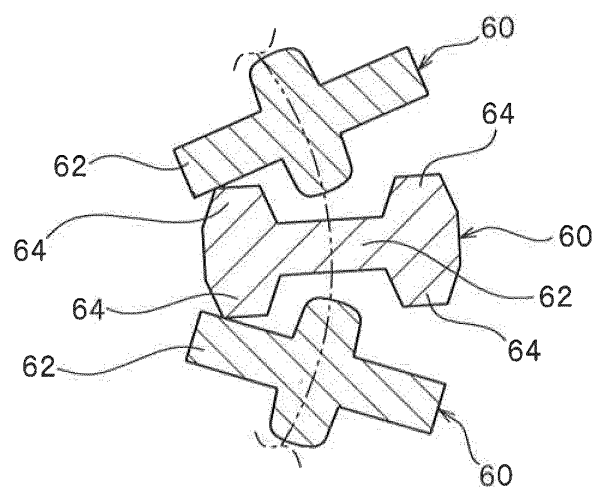


FIG.13

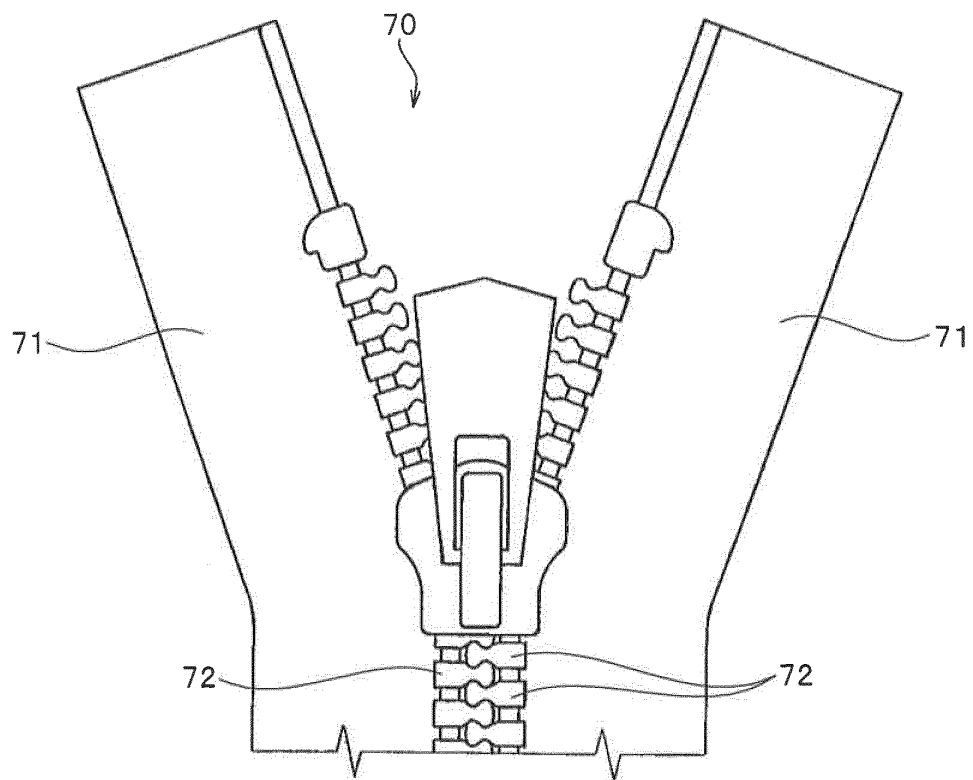
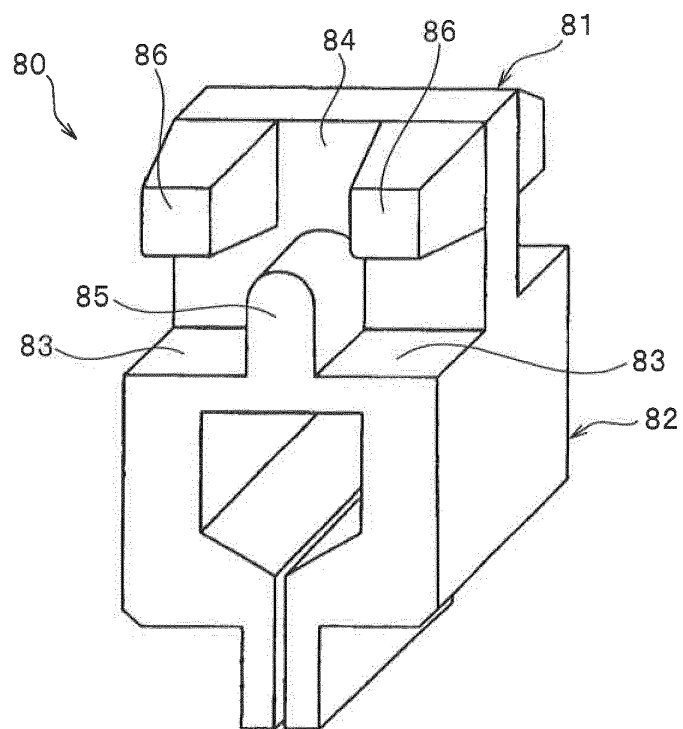


FIG.14



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/087546

A. CLASSIFICATION OF SUBJECT MATTER
A44B19/06(2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A44B19/00-19/64

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2017
Kokai Jitsuyo Shinan Koho 1971-2017 Toroku Jitsuyo Shinan Koho 1994-2017

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	JP 49-14086 Y1 (Tadao YOSHIDA), 08 April 1974 (08.04.1974), page 1, column 1, line 19 to column 2, line 2; page 2, column 2, line 15 to page 3, column 3, line 7; fig. 1 to 3 (Family: none)	1-3 5-8 4, 9
Y	WO 2014/122589 A1 (YKK CORP.), 14 August 2014 (14.08.2014), paragraphs [0011] to [0012]; fig. 3 & EP 2953495 A1 & CN 104968232 A	5-8
A	JP 55-14252 Y1 (Yoshida Kogyo Co., Ltd.), 01 April 1980 (01.04.1980), (Family: none)	1

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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 "O" document referring to an oral disclosure, use, exhibition or other means
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Date of the actual completion of the international search
13 February 2017 (13.02.17)

Date of mailing of the international search report
21 February 2017 (21.02.17)

Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/087546

5	C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
10	A	JP 38-7944 Y1 (Yoshida Kogyo Co., Ltd.), 30 April 1963 (30.04.1963), (Family: none)	1
15			
20			
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2010089854 A [0005] [0015]
- CN 200959886 [0011]
- CN 200959886 Y [0015]