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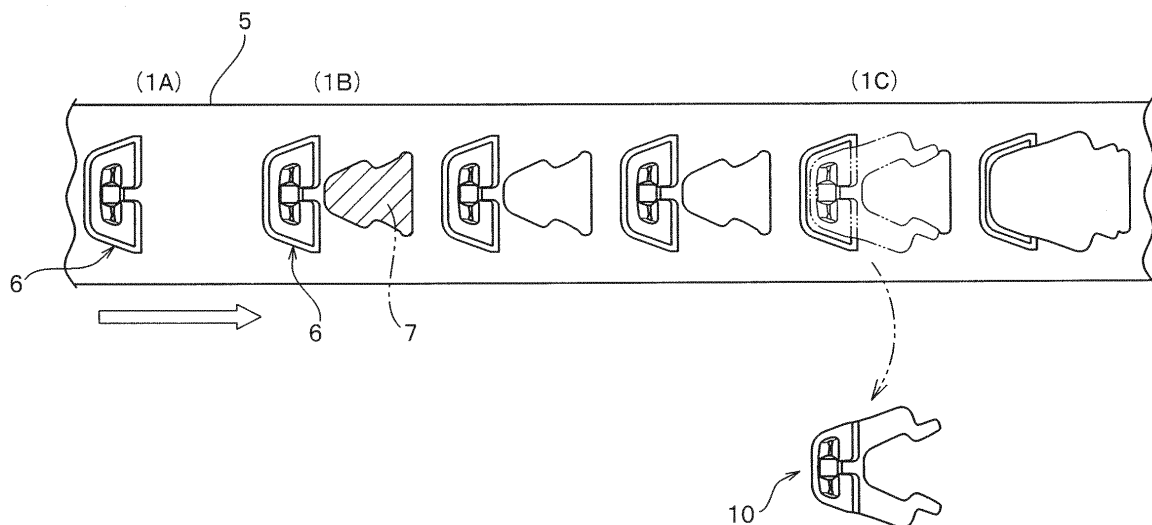
(71) Applicant: **YKK Corporation**
Tokyo 101-8642 (JP)
(72) Inventor: **TAMATE, Yoshiyuki**
3012 Prarolo (Vercelli) (IT)
(74) Representative: **Fioravanti, Corrado et al**
Jacobacci & Partners S.p.A.
Corso Emilia 8
10152 Torino (IT)

(54) **METHOD FOR MANUFACTURING FASTENER ELEMENT**

(57) Provided is a manufacturing method of manufacturing a fastener element (10) having right and left thin fin portions (24) by performing punching processing to a long metallic flat plate member (5), the method including performing at least two steps of punching processing and performing one step of the punching processing along right and left outer side surfaces of a coupling head portion (11) and right and left outer side surfaces of a tape

holding portion (21) to be formed. Thereby, it is possible that an element punch (40, 40a, 50) used for the punching processing is less likely to be damaged. It is also possible to prevent burrs or steps from being formed at a boundary part between the coupling head portion (11) and the tape holding portion (21). Further, it becomes possible to manufacture the fastener element (10) having thinner fin portions (24).

FIG. 1



Description

Technical Field

[0001] The invention relates to a manufacturing method for manufacturing metallic fastener elements for a slide fastener by performing punching processing with respect to a long and thin metallic flat plate member.

Background Art

[0002] A fastener element described in Patent Publication No. 4215660 (Patent Document 1), for example, is known as one of the metallic fastener elements used for a slide fastener.

[0003] The fastener element 70 described in Patent Document 1 has, as shown in Fig. 23, a coupling head portion 71 including a coupling convex portion 73 and a tape holding portion 72 extending from one end (rear end) of the coupling head portion 71. The fastener element 70 has a shape symmetrical in an upper and lower direction with reference to a center position in an element height direction (thickness direction), and is formed as a so-called double-sided element in which the coupling convex portion 73 is disposed on each of an upper surface side and a lower surface side of the coupling head portion 71.

[0004] The coupling head portion 71 of the fastener element 70 has a thin plate shaped flat plate portion 74 disposed on a middle part in the element height direction, coupling convex portions 73 respectively protruded on the upper surface and the lower surface of the flat plate portion 74, and a protruded edge portion 75 protruded toward a tip end of the coupling head portion 71 from the tape holding portion 72. The tape holding portion 72 of the fastener element 70 has a holding base end portion 76 connecting to the coupling head portion 71 and a pair of leg portions branching and extending to the right and left from the holding base end portion 76.

[0005] The fastener element 70 shown in Fig. 23 is illustrated in a form when the right and left leg portions 77 are pressed inward in an element width direction to be plastically deformed in order to be attached to a fastener tape. The fastener element 70 (also referred to as an element material) before being attached to the fastener tape has a form that the right and left leg portions 77 are slightly opened outward in the element width direction as compared with the form of Fig. 23.

[0006] The fastener element 70 of Patent Document 1 as above is, as shown in Fig. 24, manufactured continuously one by one by performing punching processing with respect to a metallic flat plate member 79 (also referred to as a flat rectangular wire member). In this case, the flat plate member 79 is intermittently transferred from left toward right in the drawing while temporarily stopping.

[0007] With respect to the flat plate member 79 to be transferred intermittently, first, press molding processing (press processing) of molding a shape of the coupling

head portion 71 of the fastener element 70 is performed. In the press molding processing, press molding is performed with a molding punch (press punch) to a predetermined part of the flat plate member 79 which is stopped from above and below in an area shown as (A) of Fig. 24. Thereby, a coupling head portion area E is molded on the flat plate member 79. The flat plate portion 74 and the coupling convex portion 73 of the coupling head portion 71 are formed in the coupling head portion area E.

[0008] Next, the part of the flat plate member 79 where the coupling head portion area E has been molded is moved to an area shown as (B) of Fig. 24. Subsequently, with respect to the flat plate member 79, first punching processing is performed to punch out a part of an unnecessary part which does not constitute a fastener element 70. Thus, the part indicated by hatching on the area (B) of the flat plate member 79 is cut off.

[0009] Thereafter, the part of the flat plate member 79 where the first punching processing has been performed is moved to an area shown as (C) of Fig. 24, and the second punching processing is performed with respect to the flat plate member 79 to punch out the remaining unnecessary part which does not constitute the fastener element 70. Thereby, the fastener element 70 (element material) of Patent Document 1 before being attached to the fastener tape is manufactured, as shown in (D) of Fig. 24.

[0010] In Patent Document 1, by setting a size of a gap formed between a punch and a die used for the punching processing to be within a predetermined range, it is possible to increase smoothness of an outer side surface of the coupling head portion 71 and smoothness of an outer side surface of the tape holding portion 72 in the fastener element 70. Therefore, it is possible to improve quality of the fastener element 70.

Prior Art Documents

Patent Documents

[0011] Patent Document 1: JP 4215660 B

Summary of Invention

Problems to be Solved by the Invention

[0012] In a case of the manufacturing method of the fastener element 70 in Patent Document 1 as shown in Fig. 24, the coupling head portion 71 and the tape holding portion 72 of the fastener element 70 are formed by separate punching processing from each other. Therefore, at a boundary part between the coupling head portion 71 and the tape holding portion 72 of the fastener element 70, a projecting burr or a step may be formed.

[0013] Such burrs or steps formed on the fastener elements are generally removed by subsequent polishing processing or the like of the fastener elements. However, among a large number of manufactured fastener ele-

ments, the burrs or the steps are not sufficiently removed and sometimes remained in the fastener elements. As a result, in the manufactured slide fasteners, the touch feeling and outer appearance quality of the fastener elements may be reduced.

[0014] Meanwhile, in recent years, as a metallic fastener element for a slide fastener, a fastener element in which right and left fin portions bending inward from tip end parts of the right and left leg portions and extending further rearward are provided on a tape holding portion is sometimes used. The right and left fin portions provided on the fastener element as above are formed to have the same dimension in an element height direction as the right and left leg portions (hereinafter, abbreviated as a height dimension), and is formed to be thinner than the right and left leg portions in a plan view of the fastener element when viewed from above.

[0015] Since the fastener element has the above-mentioned right and left fin portions, when the fastener element is attached to the fastener tape, 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 with respect to the fastener tape can be enhanced. Further, when the slide fastener is formed, the fin portions of the fastener element can prevent the slider (particularly, upper and lower flange portions of the slider) from directly contact-sliding on the fastener tape. Therefore, even when the slider is repeatedly slid, the fastener tape is less likely to be damaged, and durability of the fastener tape can be improved.

[0016] On the other hand, the right and left fin portions of the fastener element as above are formed to have the same height dimensions as the right and left leg portions as described above, and are formed to be narrower than the leg portions in the plan view. Therefore, in a case of performing the punching processing shown in Fig. 24, for example, to a metallic flat plate member to manufacture a fastener element having right and left fin portions, a part of the punch for punching out the fin portion also becomes thin inevitably in accordance with the shape of the fin portion in the plan view. As a result, strength of the punch is locally lowered, and the punch is likely to be damaged, thereby which causes high replacement frequency of the punches.

[0017] Further, in order for the punch to punch out a metallic flat plate member smoothly, it is necessary to form a punch tip end part of the punch to be thick to some extent to give strength to the punch tip end part. Therefore, there is a limit in reducing the thickness of the fin portion of the fastener element which is formed by one step of punching processing.

[0018] Further, in a case of forming the tape holding portion including the fin portion of the fastener element by one step of punching processing, when the flat plate member receives pressing force from the punch, the fin portion to be punched is likely to be deformed by the stress generated in the flat plate member. The fastener

element not having a predetermined shape due to deformation of the fin portion as above is treated as a defective product. Therefore, in order to improve yield of the fastener elements, it is required to manufacture the fastener elements in such a way that the fin portion is hardly deformed at the time of punching processing.

[0019] The present invention has been made in view of the above-mentioned conventional problems, and its objective is to provide a manufacturing method of a fastener element, which prevents projecting burrs or steps from being formed at the boundary part between the coupling head portion and the tape holding portion at the time of punching processing to the metallic flat plate member, and by which the fastener element having a smooth outer side surface from the coupling head portion through a tip end part of the fin portion can be manufactured, and to further provide a manufacturing method of a fastener element, by which the punch can be less likely to be broken and the fin portions can be less likely to be deformed at the time of punching processing.

Means for Solving the Problems

[0020] In order to achieve the above objective, a manufacturing method of a fastener element provided by the present invention is a manufacturing method for manufacturing a metallic fastener element comprising a coupling head portion and a tape holding portion extending one direction from the coupling head portion, wherein the tape holding portion comprises a holding base end portion connecting to the coupling head portion, a pair of leg portions branching and extending to right and left from the holding base end portion, and right and left fin portions extending from a tip end part of each leg portion and formed to be thinner than the leg portion in a plan view by performing punching processing to a long metallic flat plate member. The method includes, as the most characteristic feature, performing at least two steps of the punching processing, and performing one step of the punching processing along right and left outer side surfaces of the coupling head portion and right and left outer side surfaces of the tape holding portion to be formed.

[0021] In the manufacturing method of the fastener element according to the present invention, it is preferable that the punching processing of punching a part of the flat plate member along the right and left outer side surfaces of the tape holding portion and the punching processing of punching a part of the flat plate member along an inner side surface of the tape holding portion are performed separately.

[0022] It is also preferable that the manufacturing method of the present invention includes cutting off a part of unnecessary parts from the flat plate member by performing primary punching processing as the punching processing that is punching the part of the unnecessary parts of the flat plate member which does not constitute the fastener element, and punching the fastener element from the flat plate member by performing element-punch-

ing processing as the punching processing to the flat plate member on which the primary punching processing has been performed.

[0023] In this case, it is preferable to cut off an inside cut-off part disposed inside the tape holding portion among the unnecessary parts of the flat plate member by performing the primary punching processing, or to cut off an outside cut-off part disposed outside in a width direction of the fastener element among the unnecessary parts of the flat plate member by performing the primary punching processing.

[0024] Further, in the element punching processing of the manufacturing method of the present invention, it is preferable to use a die for supporting the flat plate member, a pressing member disposed to be able to move up and down with respect to the die and pressing and fixing the flat plate member between the die, and an element punch disposed to be able to move up and down with respect to the die and punching the fastener element from the flat plate member fixed between the die and the pressing member.

[0025] In this case, it is preferable that the element punch has a punch tip end portion contacting with the flat plate member to punch the fastener element, and a deformation-preventing protruded portion disposed to be protruded further than a tip end surface of the punch tip end portion and preventing deformation of the fastener element by being inserted into a cut-off part which has been punched out as the unnecessary parts of the flat plate member in the primary punching processing, and that the pressing member has a pressing surface contacting with an upper surface of the flat plate member to press the flat plate member.

[0026] On the other hand, it is possible that the element punch has a punch tip end portion contacting with the flat plate member to punch the fastener element, and that the pressing member has a pressing surface contacting with an upper surface of the flat plate member to press the flat plate member, and a deformation-preventing protruded portion disposed protruded further than the pressing surface and preventing deformation of the fastener element by being inserted into a cut-off part which has been punched as the unnecessary parts of the flat plate member by the primary punching processing.

[0027] Further, in the manufacturing method of the present invention, it is possible to form the fastener element by performing a plural steps of the punching processing of punching a part of unnecessary parts of the flat plate member which does not constitute the fastener element, as the punching processing.

[0028] In addition, in the manufacturing method of the present invention, it is preferable to perform press molding processing of molding a shape of the coupling head portion of the fastener element on the flat plate member before performing the punching processing.

Effects of the Invention

[0029] In the manufacturing method of the fastener element according to the present invention, a metallic fastener element in which right and left fin portions narrower than leg portions are provided on a tape holding portion is manufactured by performing two or more steps of punching processing to a flat plate member. Thereby, it becomes possible to form the right and left fin portions of the fastener element by performing at least two steps of punching processing separately.

[0030] Since the fin portions are formed by at least two steps of punching processing as above, the punch used for forming the fin portion is not necessarily to be corresponded to the shape of the fin portion in a plan view. As a result, for a shape of the punch, it is no longer necessary to select the shape having locally lowered strength, and it is possible that the punch used in each step of punching processing is formed in a shape that is able to stably secure strength. Thereby, since the punch can be less likely to be damaged, the life of the punch can be extended, which prevents increase of the replacement frequency of the punch.

[0031] In the present invention, since the fin portions can be formed by at least two steps of punching processing, it becomes possible to reduce the amount of stress applied to the fin portions by one step of punching processing, and to suppress flow of metal material generated in the flat plate member by one step of punching processing to a small degree as compared to a case that the fin portions are formed by a single step of punching processing. Further, it is possible to make the flow of the metal material generated in each step of punching processing different. As a result, in the present invention, the fin portion is less likely to be deformed during the punching processing than in the case that the fin portion is formed only by a single step of punching processing, and a plurality of fastener elements having a predetermined shape can be stably manufactured. Thereby, yield of the fastener elements can be improved.

[0032] Further, in the manufacturing method of the present invention, the fastener element is manufactured by performing at least two steps of punching processing. However, by performing any one step of punching processing along right and left outer side surfaces of a coupling head portion and right and left outer side surfaces of a tape holding portion in the fastener element, the right and left outer side surfaces of the coupling head portion and the right and left outer side surfaces of the tape holding portion are simultaneously formed. Particularly in this case, the entire right and left outer side surfaces of the fastener element from the outer side surface disposed on a tip end part of the coupling head portion to the outer side surface of the fin portion are formed by one step of punching processing. Thereby, it is possible to prevent formation of protruded burrs or steps at the boundary part between the coupling head portion and the tape holding portion of the fastener element as in the

manufacturing method of the fastener element in Patent Document 1. As a result, it is possible to manufacture the fastener element having a smooth outer side surface from the tip end part (front end part) of the coupling head portion to the tip end part (rear end part) of the fin portion, and which is capable of having good touch feeling and outer appearance quality.

[0033] In such a manufacturing method of the present invention, the punching processing of punching a part of the flat plate member along the right and left outer side surfaces of the tape holding portion and the punching processing of punching a part of the flat plate member along the inner side surface of the tape holding portion are performed separately, thereby, the right and left outer side surfaces of the tape holding portion and the inner side surface of the tape holding portion in the fastener element are formed by separate punching steps. Therefore, it becomes possible that the punches used for each step of punching processing are formed to have proper strength. Further, it is possible to form the fastener element to have thinner fin portion in the plan view.

[0034] In the manufacturing method of the present invention, the punching processing with respect to the flat plate member includes a primary punching processing of punching and cutting a part of the unnecessary part of the flat plate member which does not constitute the fastener element from the flat plate member, and an element punching processing of punching the fastener element from the flat plate member on which the primary punching processing has been performed. These two steps of punching processing which are the primary punching processing and the element punching processing are performed, thereby, the fastener element can be manufactured from the flat plate member effectively, and the punch can be less likely to be damaged.

[0035] In this case, in the above-mentioned primary punching processing, an inside cut-off part disposed inside the tape holding portion among the unnecessary parts of the flat plate member is cut off. Thereby, the punch is less likely to be damaged, and the fastener element having thinner fin portions can be smoothly manufactured. Further, the remained part of the flat plate member after the fastener element has been punched can be easily collected.

[0036] Meanwhile, in the above-mentioned primary punching processing of the present invention, it is possible to cut off outside cut-off parts disposed outside in a width direction of the fastener element among the unnecessary parts of the flat plate member. This also makes the punch less likely to be damaged, and the fastener element having thin fin portions can be manufactured smoothly.

[0037] In the element punching processing performed after the primary punching processing in the manufacturing method of the present invention, a die for supporting the flat plate member from a lower surface side, a pressing member disposed to be able to move up and down with respect to the die, and the element punch are

used. In this case, the pressing member is moved down to approach the die and to be contacted with the flat plate member, thereby the flat plate member is pressed from an upper surface side (compressed) to be temporarily fixed between the die. Subsequently, the element punch is moved down to approach the die in a state that the flat plate member is fixed between the die and the pressing member and to be contacted (collided) strongly with the flat plate member. Thereby, the fastener element can be punched from the flat plate member. By performing the element punching processing using the die, the pressing member and the element punch, the fastener element having a predetermined shape provided with the fin portions can be formed by punching from the flat plate member stably.

[0038] In this case, the element punch used for the element punching processing has a punch tip end portion for contacting the flat plate member and punching the fastener element, and a deformation-preventing protruded portion which is disposed to be protruded further than a tip end surface (lower end surface) of the punch tip end portion and is inserted into a cut-off part formed on the flat plate member in the primary punching processing. Further, the pressing member used for the element punching processing has a pressing surface which is contacted with the upper surface of the flat plate member to press the flat plate member.

[0039] The element punch provided with the deformation-preventing protruded portion as above and the pressing member pressing and fixing the flat plate member with the pressing surface are used to perform the element punching processing on the flat plate member, thereby, it is possible to stably press a side surface (inner side surface or outer side surface) of the fastener element to be punched in the element punching processing with the deformation-preventing protruded portion of the element punch. Therefore, deformation of the fastener element (particularly, deformation of the right and left fin portions) punched in the element punching processing can be more effectively suppressed to a small degree.

[0040] Meanwhile, in the manufacturing method of the present invention, the element punch used for the element punching processing has the punch tip end portion which is contacted with the flat plate member to punch the fastener element. The pressing member used for the element punching processing has the pressing surface which is contacted with the upper surface of the flat plate member to press the flat plate member, and the deformation-preventing protruded portion which is disposed to be protruded further than the pressing surface and is inserted into the cut-off part formed on the flat plate member in the primary punching processing.

[0041] The element punch and the pressing member provided with the deformation-preventing protruded portion as above are used to perform the element punching processing on the flat plate member, thereby, it is also possible to stably press the side surface (inner side surface or outer side surface) of the fastener element

punched in the element punching processing with the deformation-preventing protruded portion of the pressing member. Therefore, deformation of the fastener element (particularly, deformation of the right and left fin portions) punched in the element punching processing can be more effectively suppressed to a small degree.

[0042] Further, in the manufacturing method of the present invention, it is possible that the fastener element is formed by performing a plural steps of punching processing of punching a part of the unnecessary part of the flat plate member which does not constitute the fastener element. Thereby, the fastener element having thin fin portions can be manufactured smoothly without performing the element punching processing of punching the fastener element from the flat plate member. In addition, the punch can be less likely to be damaged.

[0043] Further, in the manufacturing method of the present invention, before the punching processing is performed, the press molding processing is performed to mold a shape of the coupling head portion of the fastener element to the flat plate member. As a result, it is possible to stably and continuously manufacture the fastener element having the coupling head portion with a predetermined shape one by one.

Brief Description of Drawings

[0044]

Fig. 1 is an explanatory view schematically explaining a method for manufacturing a fastener element from a flat plate member in Embodiment 1 of the present invention.

Fig. 2 is a perspective view schematically illustrating a part of a molding punch of Embodiment 1.

Fig. 3 is a perspective view schematically illustrating a part of an element punch of Embodiment 1.

Fig. 4 is a side view of the element punch.

Fig. 5 is a main part enlarged view which illustrates the main part of the element punch in an enlarged manner.

Fig. 6 is a side view schematically illustrating a pressing member of Embodiment 1.

Fig. 7 is a cross-sectional view schematically illustrating the element punching processing.

Fig. 8 is a perspective view schematically illustrating the relation between the fastener element punched from the flat plate member and the element punch.

Fig. 9 is a perspective view illustrating the fastener element manufactured in Embodiment 1.

Fig. 10 is a plain view of the fastener element when viewed from an element upper side.

Fig. 11 is a side view of the fastener element when viewed from the element side.

Fig. 12 is a cross-sectional view taken along line XII-XII shown in Fig. 10.

Fig. 13 is a partial cross-sectional view illustrating a state that the fastener element is attached to a fastener tape.

tener tape.

Fig. 14 is a perspective view schematically illustrating a part of an element punch according to a modification example of Embodiment 1.

Fig. 15 is a side view schematically illustrating a pressing member according to the modification example of Embodiment 1.

Fig. 16 is a cross-sectional view schematically explaining element punching processing in the modification example of Embodiment 1.

Fig. 17 is a perspective view schematically illustrating the relationship of a fastener element punched from a flat plate member, the element punch, and the pressing member in the modification example of Embodiment 1.

Fig. 18 is an explanatory view schematically explaining a method for manufacturing a fastener element from a flat plate member in Embodiment 2 of the present invention.

Fig. 19 is a bottom surface view schematically illustrating an element punch of Embodiment 2.

Fig. 20 is a cross-sectional view of a fin portion of the fastener element manufactured in Embodiment 2.

Fig. 21 is an explanatory view schematically explaining a method for manufacturing a fastener element from a flat plate member in Embodiment 3 of the present invention.

Fig. 22 is a cross-sectional view of a fin portion of the fastener element manufactured in Embodiment 3.

Fig. 23 is a perspective view illustrating a conventional metallic fastener element.

Fig. 24 is an explanatory view schematically explaining a manufacturing method of the conventional fastener element.

Modes for Carrying out the Invention

[0045] Hereinafter, favorable modes for conducting the invention will be described in detail showing embodiments with reference to the drawings. It should be noted that the present invention is not limited to the embodiments explained as below, and various changes can be made as long as having a substantially same structure as the present invention and similar functional effects to the present invention.

[0046] For example, the fastener element manufactured in the following Embodiments 1 to 3 has a coupling head portion provided with a predetermined shape described later. However, the shape of the coupling head portion of the fastener element manufactured in the present invention is not limited thereto, and can be arbitrarily changed. Further, in the following Embodiments 1 to 3, when the fastener element is manufactured from the flat plate member, press molding processing and each step of punching processing are performed such that the fastener elements are formed in a direction along

a conveying direction of the flat plate member. In the present invention, however, the direction of the fastener elements for performing the press molding processing and the punching processing with respect to the flat plate member is not particularly limited.

Embodiment 1

[0047] Fig. 1 is an explanatory view schematically explaining a method for manufacturing a fastener element from a flat plate member in Embodiment 1. Fig. 2 is a perspective view schematically illustrating a part of a molding punch of Embodiment 1. Figs. 3, 4 and 5 are a perspective view, a side view and a main part enlarged view schematically illustrating an element punch used in Embodiment 1. Fig. 9 is a perspective view illustrating the fastener element manufactured in Embodiment 1.

[0048] In the following explanation, a front and rear direction in a manufacturing step means a length direction of a metallic flat plate member conveyed in the manufacturing step of the fastener element, and particularly a direction on a downstream side in the conveyance of the flat plate member is defined as a rear, and a direction on an upstream side is defined as a front. A right and left direction and an upper and lower direction in the manufacturing step mean a width direction and a height direction (thickness direction) of the metallic flat plate member, respectively.

[0049] Regarding the fastener element itself, a front and rear direction means an element length direction, and means a direction to be a tape width direction when the fastener element is attached to the fastener tape. Particularly in a case of Embodiment 1, the front and rear direction of the manufacturing step and the front and rear direction of the fastener element are the same direction as each other. A right and left direction and an upper and lower direction of the fastener element respectively mean an element width direction and an element height direction, and mean a direction of a tape top and back direction and a tape length direction when the fastener element is attached to the fastener tape.

[0050] In the manufacturing method of Embodiment 1, the metallic flat plate member 5 is conveyed intermittently in one direction, while press molding processing and two steps of punching processing described later are respectively performed at a predetermined position (area) with respect to the flat plate member 5, thereby, the fastener element 10 as shown in Figs. 9 to 12 is continuously manufactured one by one.

[0051] Here, the fastener element 10 manufactured by the manufacturing method of Embodiment 1 has a coupling head portion 11 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 a double-sided element in which right and left pair of coupling convex portions 14, described later, are disposed on each of an upper surface side and a lower surface side of the coupling

head portion 11, and has a symmetrical shape in an upper and lower direction with respect to a center position in an element height direction.

[0052] The coupling head portion 11 has a thin plate-shaped flat plate portion 12 disposed at a central part in the upper and lower direction, a central projecting portion 13 and the right and left pair of coupling convex portions 14 protruded on each of the upper surface and the lower surface of the flat plate portion 12, and a raised portion 15 disposed between the right and left pair of the coupling convex portions 14 and formed to be raised in the upper and lower direction from each of the upper surface and the lower surface of the flat plate portion 12.

[0053] Further, 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 are formed. In this case, the right and left insertion concave portions 17 are formed to be surrounded by the coupling convex portion 14, the central projecting portion 13 and the tape holding portion 21. Into the above-mentioned insertion groove portion 16 and the right and left insertion concave portions 17 provided on the coupling head portion 11 of each fastener element 10, a central projecting portion 13 and right and left coupling convex portions 14 of a fastener element 10 on a coupling counterpart side are respectively inserted when right and left element rows are coupled in a slide fastener.

[0054] The tape holding portion 21 of the fastener element 10 has a holding base end portion 22 connecting to the coupling head portion 11, right and left pair of leg portions 23 branching to right and left from the holding base end portion 22 and extending rearward, and right and left fin portions 24 bending inward from a rear end part (tip end part) of each leg portion 23 and extending further rearward.

[0055] In this case, an upper surface and a lower surface of the tape holding portion 21 are formed to be single flat surfaces continuing to the upper surface and the lower surface of the central projecting portion 13, respectively in the coupling head portion 11. A dimension in an element height direction (height dimension) of the tape holding portion 21 is larger than a height dimension of the flat plate portion 12 of the coupling head portion 11. Furthermore, the holding base end portion 22, the leg portions 23, and the fin portions 24 of the tape holding portion 21 are formed to have a constant height dimension.

[0056] The right and left leg portions 23 are formed to be symmetrical to each other with respect to the center position in the element width direction. The right and left leg portions 23 are, in a state before the fastener element 10 is attached to a fastener tape 29 as described later, extended from the holding base end portion 22 in a direction obliquely outward with respect to the element length direction such that a distance between the right and left leg portions 23 in the element width direction gradually increases rearward. In this case, right and left

outer side surfaces of the flat plate portion 12 in the coupling head portion 11, right and left outer side surfaces of the holding base end portion 22, and outer side surfaces of the right and left leg portions 23 are disposed continuously so as to form a smooth one surface without protruded burrs or steps.

[0057] The right and left fin portions 24 extend inward from inner side surfaces of the right and left leg portions 23 at tip end parts, and further bend and extend in substantially the same direction as an extending direction of the leg portions 23. Each of the right and left fin portions 24 has an inner side surface disposed to face each other and an outer side surface disposed opposite to the inner side surface. In Embodiment 1, the outer side surface of the fin portion 24 is disposed parallel to an outer side surface of the leg portion 23. The inner side surface of the fin portion 24 is disposed to be sloped 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.

[0058] In the fastener element 10 of Embodiment 1, a dimension (hereinafter, abbreviated as width dimension) W1 in the element width direction of the fin portion 24 is smaller than the width dimension W2 of the leg portion 23. It should be noted that the width dimension W1 of the fin portion 24 and the width dimension W2 of the leg portion 23 here are referred to as the dimensions in the element width direction (dimension in a tape top and back direction) in a state that the fastener element 10 is attached to the fastener tape 29 as shown in Fig. 13. The state that the fastener element 10 is attached to the fastener tape 29 can be reworded as the state after the right and left leg portions 23 of the fastener element 10 are pressed inward and the fastener element 10 is plastically deformed so that the outer side surfaces of the right and left leg portions 23 are parallel to each other.

[0059] In this case, a maximum value of the width dimension W1 of the fin portion 24 is smaller than a minimum value of the width dimension W2 of the leg portion 23, and is preferably 80% or smaller of the minimum value of the width dimension W2 of the leg portion 23. Specifically, the maximum value of the width dimension W1 of the fin portion 24 is 0.8 mm or smaller, and preferably 0.5 mm or smaller.

[0060] When the fastener element 10 in which the right and left fin portions 24 having the small width dimension W1 as above is disposed is manufactured by punching a metallic flat plate member 5 with a single step of punching processing, for example, a part of the punch used for the punching processing for punching the fin portion 24 becomes locally thin. Therefore, strength of the part of the punch also may be locally lowered, and the punch is likely to be damaged.

[0061] On the other hand, in the Embodiment 1, the punching step (primary punching step) of forming the inner side surfaces of the fin portions 24 by performing the punching processing along the inner side surfaces of the

fin portions 24 of the fastener element 10 and the punching step (element punching step) of forming the outer side surfaces of the fin portions 24 by performing the punching processing along the outer side surfaces of the fin portion 24 are performed separately in order as described later. Therefore, the punch (also referred to as a blanking punch) used for each step of the punching processing can be less likely to be damaged.

[0062] Hereinafter, a manufacturing method of manufacturing the above-described fastener element 10 of Embodiment 1 will be specifically described.

[0063] A flat plate member 5 (also referred to as a flat rectangular wire member) made of metal from which a plurality of fastener elements 10 are punched is prepared in advance. The flat plate member 5 is formed of a metal such as copper alloy, nickel alloy, and aluminum alloy which constitute the fastener element 10. The flat plate member 5 has a rectangular lateral cross section perpendicular to the length direction, and is formed to be long in the length direction.

[0064] In the Embodiment 1, the lateral cross section of the flat plate member 5 has a rectangular shape to be long in one direction (width direction), and has a constant size and shape over the entire length direction of the flat plate member 5. Further, the flat plate member 5 has the height dimension (thickness dimension) equal to the height dimension of the tape holding portion 21 of the fastener element 10. In the present invention, the shape and the dimension of the flat plate member 5 is not particularly limited, however, it is preferable that the flat plate member 5 used for manufacturing the fastener element 10 is a metallic member in which an upper surface (top surface) and a lower surface (back surface) of the member are formed in planes parallel to each other, and which is long in one direction.

[0065] The flat plate member 5 prepared in Embodiment 1 is conveyed intermittently using a conveying apparatus (not shown) toward a downstream side (rear) of the conveying direction (from left to right in Fig. 1) while repeating moves and stops. In this case, conveying conditions such as a conveying speed, moving distance in one move, and stop time of the flat plate member 5 can be arbitrarily set.

[0066] Further, a part (remained part) of the flat plate member 5 after the fastener element 10 has been punched is conveyed further rearward and collected by a collecting apparatus (not shown). In Embodiment 1, conveying method and conveying means (conveying apparatus) of the flat plate member 5, and collecting method and collecting means of the flat plate member 5 after the element punching has been performed are not particularly limited, and conventional general methods and means can be used.

[0067] In this case, the flat plate member 5 is linearly conveyed by the conveying apparatus (not shown) such that the upper surface (top surface) and the lower surface (back surface) of the flat plate member 5 are perpendicular to a moving direction of a molding punch 30 used

for press molding processing and the moving direction of the element punch 40 used for each step of punching processing.

[0068] In the manufacturing method of the present Embodiment 1, first, with respect to the flat plate member 5 conveyed intermittently by the conveying apparatus, press molding step (also referred to as head molding step) is performed to mold a shape of the coupling head portion 11 of the fastener element 10. In the press molding step, an element part which is to be a processed part of the flat plate member 5 is transferred to a processing area 1A of Fig. 1 where the press molding processing is performed, and the press molding processing is performed using an upper and lower pair of the molding punches 30 with respect to the element part of the flat plate member 5.

[0069] Here, a part of the molding punch 30 on an upper side which is disposed above the flat plate member 5 is shown in Fig. 2. The molding punch on a lower side which is disposed below the flat plate member 5 has a vertically symmetrical shape with the molding punch 30 on the upper side. Therefore, detailed explanation of the molding punch on the lower side will be omitted.

[0070] The upper side molding punch 30 used for the press molding processing is provided with a pressing portion 31 which locally presses and plastically deforms the flat plate member 5 on a tip end part (lower end part) of the molding punch 30. The pressing portion 31 of the upper side molding punch 30 has a shape corresponding to a concavo-convex shape of the coupling head portion 11 to be able to mold the above-mentioned shape of the coupling head portion 11 of the fastener element 10 on an upper surface part of the flat plate member 5.

[0071] Specifically, the pressing portion 31 of the upper side molding punch 30 has a press tip end surface 32 that collides with the flat plate member 5. The press tip end surface 32 is formed to be slightly larger than the flat plate portion 12 of the coupling head portion 11 in the plan view of the fastener element 10.

[0072] In the pressing portion 31 of the upper side molding punch 30, a right and left pair of first concaved portions 33 for molding a shape of the right and left coupling convex portions 14 of the fastener element 10, a second concaved portion 34 for molding a shape of the central projecting portion 13 of the fastener element 10, and a third concaved portion 35 for molding a shape of the raised portion 15 of the fastener element 10 are concaved on the press tip end surface 32 in a predetermined position and shape corresponding to a position and shape of each part of the fastener element 10.

[0073] In Embodiment 1, the press molding processing is performed on the flat plate member 5 using the upper and lower pair of the molding punches 30 having the above-mentioned shape. That is, the upper and lower molding punches 30 are moved along the upper and lower direction toward the flat plate member 5, and the flat plate member 5 is pressed with the pressing portion 31 of the molding punch 30 toward an inside of the height

direction, thereby a part of the flat plate member 5 is plastically deformed. At this time, it is preferable that the above-mentioned press molding processing is performed using a support member (not shown) and a pressing member, for example, in a state that the flat plate member 5 is held from above and below to be temporarily fixed. Thus, as shown in Fig. 1, a head portion-molded portion 6 having the shape of the coupling head portion 11 is formed on the upper surface and the lower surface of the flat plate member 5.

[0074] After the press molding processing of the coupling head portion 11 is performed on the part of the flat plate member 5 as mentioned above, the flat plate member 5 is conveyed for a predetermined distance and stopped. Further, after the flat plate member 5 is stopped, the above-mentioned press molding processing is performed again in the processing area 1A. Thereby, on an upstream side (front side) of the head portion-molded portion 6 which has been previously molded, another head portion-molded portion 6 having the shape of the coupling head portion 11 is formed at a position apart with the predetermined distance. The intermittent conveyance and the above-mentioned press molding processing of the flat plate member 5 are repeatedly performed, thereby, a plurality of the head portion molded portions 6 are formed on the flat plate member 5 along the length direction of the flat plate member 5 at a predetermined pitch.

[0075] Subsequently, the element part (processed part) on which the head portion molded portion 6 of the flat plate member 5 is formed is moved to the downstream side by the intermittent conveyance of the flat plate member 5, and is conveyed to a processing area 1B where the primary punching processing is performed shown in Fig. 1. In the processing area 1B, the primary punching processing is performed to punch a part of unnecessary parts of the flat plate member 5 which does not constitute the fastener element 10.

[0076] In Embodiment 1, after the element part of the flat plate member 5 on which the head portion molded portion 6 is formed in the processing area 1A at the time of the press molding step is moved once to the downstream side by the above-mentioned intermittent conveyance to be transferred to the processing area 1B, the primary punching processing is performed to the element part. In the present invention, however, it is also possible that the element part on which the head portion molded portion 6 is formed in the press molding step is moved to the downstream side by the intermittent conveyance more than one time, thereafter, the primary punching processing is performed. In other words, it is also possible to provide a non-processing area where no processing is performed between the press molding step and the primary punching step.

[0077] In the primary punching step of Embodiment 1, the primary punching processing is performed for punching and cutting off a predetermined part (inside cut-off part 7 described later) of the flat plate member 5 using a

primary punch (not shown) and a primary punching die (not shown) having a space part corresponding to the primary punch. In the primary punching processing, with respect to the element part of the flat plate member 5 placed on the primary punching die, the primary punch (not shown) is moved down from above to collide with the flat plate member 5, thereby, the inside cut-off part 7 of the flat plate member 5 is cut off.

[0078] The primary punch (not shown) used in the primary punching step has a punch tip end portion of contacting with the predetermined part of the flat plate member 5 from an upper surface side strongly and performing shearing processing. The punch tip end portion of the primary punch is formed such that the cross-section perpendicular to the upper and lower direction has the same shape as the part punching the flat plate member 5.

[0079] In the case of the present Embodiment 1, since the inside cut-off part 7 which is on the inner side of the tape holding portion 21 of the fastener element 10 in the flat plate member 5 is cut off in the primary punching processing, the punch tip end portion of the primary punch is formed such that the cross-section perpendicular to the upper and lower direction has a shape corresponding to the inside cut-off part 7 of the flat plate member 5. Since the punch tip end portion of the primary punch is formed in the above-mentioned shape, strength of the punch tip end portion can be secured properly. Even when the primary punching processing is repeatedly performed to the flat plate member 5, the punch tip end portion of the primary punch can be less likely to be damaged.

[0080] In the primary punching processing of Embodiment 1, the primary punch (not shown) as above is moved down, and the punch tip end portion is collided with the flat plate member 5 from an upper surface side so as to be along an inner side surface (inner peripheral surface) of the tape holding portion 21 to be formed. Thereby, as a part of the unnecessary parts (part except for the part on which the fastener element 10 is formed) in the flat plate member 5, the above-mentioned inside cut-off part 7 is punched and cut off.

[0081] By performing the primary punching processing as above, the inner side surface of the part which is to be the tape holding portion 21 of the element part (i.e., each inner side surface of the holding base end portion 22, the right and left leg portions 23, and the right and left fin portions 24 of the fastener element 10 to be formed) is formed. The inside cut-off part 7 punched from the flat plate member 5 in the primary punching processing is dropped and collected in a collecting box placed below a conveyance pass of the flat plate member 5. When the primary punching processing is performed, it is preferable that the flat plate member 5 is held and fixed temporarily from the upper and lower direction, using a support member (not shown) and the pressing member, for example.

[0082] Next, the element part in which the inside cut-off part 7 is cut off in the above-mentioned primary punch-

ing step is moved to the downstream side by the intermittent conveyance of the flat plate member 5, thereby to be transported to a processing area 1C for performing the element punching processing. In the processing area 1C, element punching processing is performed to punch the fastener elements 10 from the flat plate member 5 one by one. In Embodiment 1, after the element part in which the inside cut-off part 7 has been cut off in the primary punching step is moved and stopped repeatedly for three times by the intermittent conveyance by the conveying apparatus (not shown), the element punching step is performed at the stopped position (processing area 1C).

[0083] That is, between the primary punching processing and the element punching processing of Embodiment 1, two non-processing areas where only intermittent conveyance including moves and stops is performed without any processing are provided. When the primary punching processing or the element punching processing is performed on the flat plate member 5, for example, strong impact may be given or a flow of a metal material may occur on the flat plate member 5. Therefore, since one or a plurality of non-processing area as above is provided between the primary punching processing and the element punching processing, even when the primary punching processing and the element punching processing are simultaneously performed on different parts of the flat plate member 5, it becomes possible to suppress the influence of each step of punching processing on the other step of punching processing due to the strong impact or the flow of the material generated at the time of the punching processing.

[0084] In the present invention, it is possible to arbitrarily select whether or not to provide the above-mentioned non-processing area between the primary punching processing and the element punching processing. That is, in the present invention, it is possible to perform the element punching processing after moving the element part on which the primary punching processing has been performed once to the downstream side by the intermittent conveyance without providing the non-processing area between the primary punching processing and the element punching processing. It is also possible to perform the element punching processing after the element part on which the primary punching processing has been performed is moved to the downstream side by the intermittent conveyance at an arbitrary number of times of two or four times or more.

[0085] In the element punching processing of Embodiment 1, an element punching die 80 (can be abbreviated simply as "die") for supporting the flat plate member 5, an element punch 40 which is able to move in the upper and lower direction (be moved up and down) with respect to the element punching die 80 as shown in Figs. 3 to 5, and a pressing member 60 which is able to move in the upper and lower direction with respect to the element punching die 80 as shown in Fig. 6 are used to perform the element punching processing of punching the fasten-

er elements 10 shown in Figs. 9 to 12 from the flat plate member 5.

[0086] The element punching die 80 is, as shown in Fig. 7, for example, disposed below the flat plate member 5, and receives at least the element part or nearby of the flat plate member 5 and supports the element part from the lower surface (back surface) side at the time of the element punching processing. The element punching die 80 is provided with a penetrating hole portion penetrating along the upper and lower direction.

[0087] The penetrating hole portion of the element punching die 80 is formed such that the cross section perpendicular to the upper and lower direction of the penetrating hole portion corresponds to the cross section perpendicular to the upper and lower direction of the element punch 40 (punch tip end portion 41 and deformation-preventing protruded portion 42). Thereby, when the element punching processing is performed, it is possible that a punching tip end portion 41 and a deformation-preventing protruded portion 42 as describer later, of the element punch 40 are entered into the inside of the penetrating hole portion of the element punching die 80, and that the fastener element 10 which has been punched from the flat plate member 5 is dropped through the penetrating hole portion.

[0088] The element punch 40 shown in Figs. 3 to 5 has the punch tip end portion 41 for contacting strongly with a predetermined part of the flat plate member 5 to perform shear processing, and the deformation-preventing protruded portion 42 disposed to be protruded further than a tip end surface of the punch tip end portion 41. The punch tip end portion 41 of the element punch 40 is formed such that an outer shape of the punch tip end surface when viewed from below is the same shape as an outer shape of the fastener element 10 in the plan view of the fastener element 10.

[0089] The punch tip end portion 41 of the element punch 40 has a front-side punching portion (head portion-side punching portion) 43 contacting with the part which is to be the coupling head portion 11 of the flat plate member 5 and a rear-side punching portion (holding portion-side punching portion) 44 contacting with the part which is to be the tape holding portion 21 of the flat plate member 5. Between the front-side punching portion 43 and the rear-side punching portion 44, a step portion 45 corresponding to the step portion 20 of the fastener element 10 is provided.

[0090] In this case, in the front-side punching portion 43 of the punch tip end portion 41, a right and left pair of first concave portions 46 into which the part which is to be the right and left coupling convex portions 14 of the fastener element 10 is accommodated, a second concave portion 47 into which the part which is to be the central projecting portion 13 of the fastener element 10 is accommodated, and a third concave portion 48 into which the part which is to be the raised portion 15 of the fastener element 10 are provided at a predetermined position and in a predetermined shape corresponding to

the position and the shape of each part of the fastener element 10. The rear-side punching portion 44 of the punch tip end portion 41 has, when the element punch 40 is viewed from below, the same shape as the tape holding portion 21 in the plan view of the fastener element 10.

[0091] The deformation-preventing protruded portion 42 of the element punch 40 is disposed to be protruded downward the tip end surface of the punch tip end portion 41. In this case, a protrusion length protruded from the tip end surface of the punch tip end portion 41 in the deformation-preventing protruded portion 42 is larger than the dimension (hereinafter abbreviated as a thickness dimension) of the flat plate member 5 in the upper and lower direction, and i.e., is larger than the thickness dimension of the tape holding portion 21 of the fastener element 10. When the element punch 40 is viewed from below, the deformation-preventing protruded portion 42 has a shape able to be inserted into the inside cut-off part 7 which has been cut at the time of the primary punching processing (preferably the same shape or substantially the same as the inside cut-off part 7), and is formed to have the same size or slightly smaller than the inside cut-off part 7.

[0092] The above-mentioned deformation-preventing protruded portion 42 of the element punch 40 is, when the element punch 40 is moved down from above of the flat plate member 5, inserted into the part of the flat plate member 5 in which the inside cut-off part 7 has been punched before the punch tip end portion 41 of the element punch 40 is collided with the flat plate member 5. Further, the inserted deformation-preventing protruded portion 42 is contacted with the inner side surface of the part which is to be the tape holding portion 21 of the fastener element 10 in the flat plate member 5. Therefore, when the fastener element 10 is punched from the flat plate member 5 with the element punch 40, the tape holding portion 21 of the fastener element 10 is supported from the inner side surface side. Thereby, it is possible to effectively prevent the tape holding portion 21 from being deformed, particularly the fin portions 24 of the tape holding portion 21 from being deformed at the time of the element punching.

[0093] Furthermore, the punch tip end portion 41 of the element punch 40 in Embodiment 1 is integrally formed to be connected to the deformation-preventing protruded portion 42 disposed inside. Therefore, strength of the punch tip end portion 41 of the element punch 40 is appropriately ensured. Even when the element punching processing is repeatedly performed on the flat plate member 5, the punch tip end portion 41 of the element punch 40 can be less likely to be damaged.

[0094] The pressing member 60 shown in Fig. 6 has a pressing surface 61 contacting with the upper surface (top surface) of the flat plate member 5 and pressing the flat plate member 5 from above, and a pressing projected portion 62 which is protruded downward from the pressing surface 61. In the pressing member 60, an insertion

hole portion 63 through which the element punch 40 that moves along the upper and lower direction can be inserted is formed along the upper and lower direction. Such a pressing member 60 presses the flat plate member 5 with a predetermined force from above, thereby, the pressing member 60 and the element punching die 80 cooperate to fix the flat plate member 5 temporarily so as not to move.

[0095] In this case, the pressing surface 61 of the pressing member 60 is formed as a flat surface perpendicular to the upper and lower direction. The pressing projected portion 62 of the pressing member 60 is formed to be able to enter into the head portion molded portion 6 which has been formed on the flat plate member 5, to be contacted with the remained part of the head portion molded portion 6 that is not punched as the fastener element 10, and to press the remained part from above. Since the pressing member 60 has such a pressing projected portion 62, it is possible to press and fix the flat plate member 5 with the pressing member 60 at a predetermined position more properly from the upper surface side. As a result, it is possible to stably punch a predetermined part of the fastener element 10 with the element punch 40. A cross-section of an insertion hole portion 63 formed on the pressing member 60 perpendicular to the upper and lower direction has a shape corresponding to a cross-section of the element punch 40 perpendicular to the upper and lower direction.

[0096] In the element punching processing of Embodiment 1, first, the element part and nearby of the flat plate member 5 which has been moved to the processing area 1C are pressed from above with the pressing member 60, thereby, the flat plate member 5 is held and temporarily fixed with the pressing member 60 and the element punching die 80 from above and below with a predetermined force.

[0097] Next, the element punch 40 is moved down via the insertion hole portion 63 of the pressing member 60, the deformation-preventing protruded portion 42 of the element punch 40 is inserted into the inside cut-off part 7 of the flat plate member 5, and an outer peripheral surface of the deformation-preventing protruded portion 42 is contacted or approximated with an inner wall surface (cut surface) of the inside cut-off part 7 in the flat plate member 5 parallel to the upper and lower direction. Being approximated here means that the outer peripheral surface of the deformation-preventing protruded portion 42 is not contacted with the inner wall surface of the flat plate member 5, but is disposed such that a gap formed between the outer peripheral surface of the deformation-preventing protruded portion 42 and the inner wall surface of the flat plate member 5 becomes extremely small (0.5 mm or smaller, for example).

[0098] Furthermore, after the deformation-preventing protruded portion 42 is inserted into the inside cut-off part 7 of the flat plate member 5, the element punch 40 is subsequently moved down, and the punch tip end portion 41 is strongly collided with the upper surface of the flat

plate member 5. At this time, the punch tip end portion 41 of the element punch 40 is collided with the flat plate member 5 so as to be along the position of the tip end surface and the right and left outer side surfaces of the coupling head portion 11 and the position of the right and left outer side surfaces of the tape holding portion 21. Thereby, as shown in Figs 7 and 8, the fastener element 10 shown in Figs 9 to 12 is formed by being punched from the flat plate member 5. In Fig. 8, in order to make it easier to understand the relation between the element punch 40, the flat plate member 5, and the fastener element 10, the illustration of the element punching die 80 and the pressing member 60 is omitted.

[0099] In Embodiment 1 in particular, the right and left outer side surfaces of the coupling head portion 11 and the right and left outer side surfaces of the tape holding portion 21 in one fastener element 10 are simultaneously formed by the element punching processing. That is, in Embodiment 1, the right and left continuous outer side surfaces of the fastener element 10 which is disposed from a tip end part (front end part) of the coupling head portion 11 to a tip end part (rear end part) of the fin portion 24 are simultaneously formed by one step of the element punching processing.

[0100] As a result, it is possible to prevent the formation of protruded burrs or steps at a boundary part between the coupling head portion 11 and the tape holding portion 21 of the fastener element 10. Therefore, the right and left outer side surfaces of the fastener element 10 can be finished into a smooth and fine continuous surface from the tip end part (front end part) of the coupling head portion 11 to the tip end part (rear end part) of the fin portion 24.

[0101] The fastener element 10 punched from the flat plate member 5 by the above-mentioned element punching processing is dropped into the collecting box placed below the element punching die 80 to be collected. By performing the element punching processing as above in accordance with the timing of the stops in the intermittent conveyance of the flat plate member 5 described above, a plurality of fastener elements 10 having the same shapes can be continuously manufactured one by one.

[0102] After moving up the element punch 40 by which the fastener element 10 has been punched, the remained part of the flat plate member 5 after the fastener element 10 is punched is released from the temporary fixing of the flat plate member 5 with the pressing member 60 and the element punching die 80 by moving up the pressing member 60. Afterwards, the remained part is conveyed to the downstream side by the intermittent conveyance of the flat plate member 5 and collected by the collecting apparatus (not shown) as mentioned above. Therefore, the remained part of the flat plate member 5 can be collected easily and recycled.

[0103] The plurality of manufactured fastener elements 10 punched from the flat plate member 5 as mentioned above are put into a treatment container (barrel)

and subjected to a polishing treatment, for example, so that gloss can be applied to the fastener elements 10. In Embodiment 1, it is possible to perform coating treatment, plating treatment, and the like on the plurality of formed fastener elements 10. Thereby, it is possible to apply a desired color to the fastener element 10 to further improve the outer appearance quality of the fastener element 10 and to improve the corrosion resistance of the fastener element 10.

[0104] According to the manufacturing method of the above-mentioned Embodiment 1, it is possible that the primary punch (not shown) and the element punch 40 are less likely to be damaged and the fastener element 10 having the fin portions with a predetermined shape is stably manufactured. In the manufacturing method of Embodiment 1, since the fastener element 10 can be manufactured by performing one step of the press molding processing and two steps of punching processing on the flat plate member 5, the fastener element 10 can be manufactured more effectively as compared with a manufacturing method of performing one step of the press molding processing and three steps of the punching processing on the flat plate member 5 as in Embodiment 3 described later, for example.

[0105] In the plurality of the fastener elements 10 manufactured by the manufacturing method of Embodiment 1, the right and left outer side surfaces of the fastener element 10 are formed to be finished into the smooth and fine continuous surface by single step of the element processing. Therefore, when the fastener elements 10 are attached to a fastener tape 29, described later, to form a fastener stringer 28, the fastener elements 10 can be provided with good touch feeling and excellent outer appearance quality.

[0106] Further, in the fastener element 10 of Embodiment 1, the inner side surface and the outer side surface of the fin portion 24 provided to be thin at a rear end part of the fastener element 10 are, as mentioned above, formed by performing separate punching processing which are the primary punching processing and the element punching processing. Therefore, the right and left fin portions 24 of the fastener element 10 manufactured in Embodiment 1 can be formed to be thinner in the plan view, as compared to a case that the inner side surface and the outer side surface of the fin portion are formed by only one step of the punching processing, for example.

[0107] In addition, the element punch 40 used for the element punching processing of Embodiment 1 has the above-mentioned deformation-preventing protruded portion 42. Therefore, when the element punching processing is performed with the element punch 40, the deformation-preventing protruded portion 42 of the element punch 40 is contacted (approximated) with the inner side surface of the tape holding portion 21 in the fastener element 10 to be punched. Thereby, it is possible to prevent the tape holding portion 21 of the fastener element 10, particularly the right and left fin portions 24 of the fastener element 10 from being deformed at the time of

the element punching more effectively. Therefore, in the plurality of the fastener elements 10 manufactured in Embodiment 1, each fastener element 10 can stably have a similar shape, and variations in the shapes of the fin portions 24 among the plurality of the fastener elements 10 can be effectively prevented.

[0108] In the fastener element 10 of Embodiment 1, in particular, the inner side surfaces and the outer side surfaces of the right and left leg portions 23 and the fin portions 24 are formed by the separate steps of the punching processing which are the primary punching processing and the element punching processing. Therefore, the right and left leg portions 23 and the fin portions 24 of Embodiment 1 have characteristic cross-sectional shapes different from the conventional general metallic fastener element.

[0109] Here, the cross-sectional shape of the right and left fin portions 24 of Embodiment 1 will be described in more detail with reference to Fig 12. In the fin portion 24 of Embodiment 1, the inner side surface of the fin portion 24 is formed by moving down the primary punch from above and punching the inside cut-off part 7 of the flat plate member 5. Therefore, a ridge line portion 24a on an inner peripheral side at an upper end part of the right and left fin portions 24 is formed to have a curved cross-sectional shape so as to be chamfered due to the effect by the flow (dripping) of metal material occurred at the time of the primary punching processing. A ridge line portion 24b on the inner peripheral side at a lower end part of the right and left fin portions 24 is, since the primary punching processing is performed in a state that a lower end surface of the fin portion 24 is contacted with the primary punching die (not shown), formed to have a cross-sectional shape that is angular to an outside compared to the ridge line portion 24a on the inner peripheral side at the upper end part.

[0110] On the other hand, the outer side surface of the fin portion 24 of Embodiment 1 is formed by moving down the element punch 40 from above and punching the fastener element 10 itself. In the element punching processing, the element punching processing is performed in a state that an upper end surface of the fin portion 24 is contacted with a tip end surface (lower end surface) of the element punch 40. Therefore, a ridge line portion 24c on an outer peripheral side at the upper end part of the right and left fin portions 24 is formed to have a cross-sectional shape that is angular to the outside compared to the ridge line portion 24a on the inner peripheral side at the upper end part. Further, a ridge line portion 24d on the outer peripheral side at the lower end part of the right and left fin portions 24 is formed to have a curved cross-sectional shape so as to be chamfered due to the effect by the flow (dripping) of metal material occurred at the time of the element punching processing.

[0111] In the fastener element 10 of Embodiment 1, the right and left leg portions 23 are, as in the case with the right and left fin portions 24, also formed such that the cross-sectional shapes of the ridge line portions 24a,

24c on the inner peripheral side and the outer peripheral side at the upper end part are different from each other, and the cross-sectional shapes of the ridge line portions 24b, 24d on the inner peripheral side and the outer peripheral side at the lower end part are different from each other.

[0112] For example, in a case of manufacturing a fastener element by performing one step of the punching processing from the metallic flat plate member 5 in a conventional method, an upper surface of the tape holding portion of the fastener element obtained by being punched is formed to be flat. Both of the ridge line portion on the inner peripheral side and the ridge line portion on the outer peripheral side of the tape holding portion at the upper end part are formed to have cross-sectional shapes that are angular to the outside. In this case, when the plurality of manufactured fastener elements are put into the treatment container as described above, for example, to perform polishing treatment or coating treatment while rotating the treatment container, due to the relation between the surface tension of the liquid such as polishing agent or coating material adhering to each fastener element and the atmospheric pressure, a flat upper surface of a fastener element and a flat upper surface of another fastener element may be stuck to each other due to a capillary phenomenon, so that the fastener elements stick to each other and cannot be easily separated.

[0113] On the contrary, since the right and left leg portions 23 and the fin portions 24 of the fastener element 10 in Embodiment 1 have the characteristic cross-sectional shapes such that the ridge line portion 24a on one side of the upper end part and the ridge line portion 24d on one side of the lower end part are curved as mentioned above, even when the polishing processing, the coating processing, and the like is performed on the plurality of manufactured fastener elements 10, for example, the fastener elements 10 are less likely to be stuck to each other due to capillary phenomenon. Therefore, the polishing processing, the coating processing, and the like can be stably performed on the plurality of the fastener elements 10 of Embodiment 1.

[0114] The plurality of the fastener elements 10 manufactured by the manufacturing method of Embodiment 1 as mentioned above are put into a parts feeder (not shown), and the posture of the fastener elements 10 is adjusted. Subsequently, the fastener elements 10 are supplied one by one to a tape side edge part of the fastener tape 29 via a shooter (not shown) such that a tape end edge part is held between the right and left leg portions 23 of the fastener element 10.

[0115] Thereafter, the fastener element 10 supplied to the tape side edge part of the fastener tape 29 is plastically deformed such that the right and left leg portions 23 of the fastener element 10 are pressed toward the fastener tape 29 using a pressing means (not shown). Thereby, as shown in Fig. 13, each of the fastener elements is serially attached to the tape side edge part of the fastener

tape 29 to manufacture the fastener stringer 28 in which the element row consisting of the plurality of the fastener elements 10 is formed at the tape side edge part of the fastener tape 29 along the tape length direction.

[0116] At this time, the right and left leg portions 23 of the fastener element 10 are plastically deformed, thereby the right and left outer side surfaces of the holding base end portion 22, 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 in the tape holding portion 21 are disposed to be parallel to the element length direction. Further, the step portion 20 formed between the coupling head portion 11 and the tape holding portion 21 of the fastener element 10 is, with respect to the element width direction, disposed obliquely such that right and left outer side end parts of the step portion 20 are disposed to a rear of inner side end parts of the step portion 20 connecting to the central projecting portion 13.

[0117] Furthermore, the two fastener stringers 28 manufactured as above are combined in a right and left pair, and a slider is assembled to the element rows of both fastener stringers 28, etc., thereby a slide fastener (not shown) is manufactured. In the slide fastener manufactured as above, since the outer side surface of each fastener element 10 is formed to be smooth, the slide fastener becomes excellent in touch feeling and outer appearance quality of the fastener elements 10.

[0118] In the manufacturing method of the fastener element in the above-mentioned Embodiment 1, with respect to the element part of the flat plate member 5 which has been moved to the processing area 1C, the element punch 40 having the deformation-preventing protruded portion 42 as shown in Figs. 3 to 5 and the pressing member 60 as shown in Fig. 6 are used to perform the element punching processing to the flat plate member 5 supported by the element punching die 80, thereby the fastener element 10 is punched from the flat plate member 5.

[0119] In the present invention, however, as a modification example of Embodiment 1, an element punch 40a as shown in Fig. 14 and a pressing member 60a as shown in Fig. 15 instead of the element punch 40 as shown in Figs. 3 to 5 and the pressing member 60 as shown in Fig. 6 can be used to perform the element punching processing to the flat plate member 5.

[0120] The element punch 40a according to the modification example shown in Fig. 14 has a punch tip end portion 41a which is strongly contacted with a predetermined part of the flat plate member 5 to perform shear processing. The punch tip end portion 41a itself is formed to be the same shape as the punch tip end portion 41 of the element punch 40 in Embodiment 1 shown in Figs 3 to 5. Therefore, in the punch tip end portion 41a of Fig. 14, the parts having the same structure as the punch tip end portion 41 of Embodiment 1 will be denoted by the same reference numerals, and description thereof will be omitted.

[0121] On the other hand, the element punch 40a is not provided with the deformation-preventing protruded

portion 42 disposed on the element punch 40 of Embodiment 1. Alternatively, the element punch 40a is provided with an enter-permitting hole portion 49 in which a deformation-preventing protruded portion 64, described later, of the pressing member 60a along the upper and lower direction.

[0122] The pressing member 60a according to the modification example shown in Fig. 15 has a pressing surface 61a contacting with the upper surface (top surface) of the flat plate member 5 and pressing the flat plate member 5 from above, a pressing projected portion 62a and a deformation-preventing protruded portion 64 protruded downward from the pressing surface 61a. The pressing surface 61a and the pressing projected portion 62a of the pressing member 60a according to the modification example are formed substantially in the same manner as the pressing surface 61 and the pressing projected portion 62 of the pressing member 60 of the Embodiment 1 shown in Fig. 6. In the pressing member 60a, an insertion hole portion 63a through which the element punch 40a that moves along the upper and lower direction can be inserted is formed along the upper and lower direction.

[0123] The deformation-preventing protruded portion 64 of the pressing member 60a according to the modification example is formed to have a larger protrusion length protruded downward from the pressing surface 61a than a thickness dimension of the flat plate member 5. In this case, the cross section of the deformation-preventing protruded portion 64 perpendicular to the upper and lower direction has the same shape as the cross section of the deformation-preventing protruded portion 42 perpendicular to the upper and lower direction in the element punch 40 of Embodiment 1 shown in Figs 3 to 5.

[0124] Such a deformation-preventing protruded portion 64 of the pressing member 60a is, when the pressing surface 61a of the pressing member 60a is contacted with the upper surface of the flat plate member 5, inserted into a space part of the flat plate member 5 in which the inside cut-off part 7 has been punched, thereby an outer peripheral surface of the deformation-preventing protruded portion 64 can be contacted (or approximated) with an inner side surface of the part which is to be the tape holding portion 21 of the fastener element 10 in the flat plate member 5.

[0125] When the element punching processing is performed using the element punch 40a and the pressing member 60a according to the above-mentioned modification example, and the flat plate member 5 is fixed between the pressing member 60a and the element punching die 80, the deformation-preventing protruded portion 64 of the pressing member 60a is inserted into the space part of the flat plate member 5. Thereby, the part which is to be the tape holding portion 21 of the fastener element 10 can be supported by the deformation-preventing protruded portion 64 of the pressing member 60a from the inner side surface side.

[0126] Subsequently, in a state that the deformation-

preventing protruded portion 64 of the pressing member 60a is inserted into the space part of the flat plate member 5, the element punch 40a is moved down and strongly collided with the upper surface of the flat plate member 5. Thereby, as shown in Figs 16 and 17, the fastener element 10 can be punched from the flat plate member 5. In Fig. 17, in order to make it easier to understand the relation between the element punch 40a, the deformation-preventing protruded portion 64 of the pressing member 60a, the flat plate member 5, and the fastener element 10, illustration of the element punching die 80 is omitted.

[0127] At this time, the tape holding portion 21 of the fastener element 10 to be punched is supported by the deformation-preventing protruded portion 64 of the pressing member 60a from the inner side surface side as mentioned above. Therefore, also by performing the element punching processing according to the modification example, as in the case with the element punching processing of the above-described Embodiment 1, it is possible to effectively prevent the tape holding portion 21, particularly to the fin portions 24 of the tape holding portion 21, from being deformed at the time of the element punching.

Embodiment 2

[0128] Fig. 18 is an explanatory view schematically explaining a method for manufacturing a fastener element from a flat plate member in Embodiment 2. Fig. 19 is a bottom surface view schematically illustrating an element punch of Embodiment 2. Fig. 20 is a cross-sectional view of a fin portion of the fastener element manufactured in Embodiment 2.

[0129] In a manufacturing method of Embodiment 2, a metallic flat plate member 5 is conveyed intermittently in one direction, while press molding processing of a coupling head portion 11 and two steps of punching processing are performed at a predetermined position with respect to the metallic flat plate member 5. Thereby, the fastener elements 10 shown in Figs. 9 to 11 can be serially manufactured one by one.

[0130] The fastener element 10 manufactured in Embodiment 2 has the same shape as the fastener element 10 manufactured in the above-mentioned Embodiment 1 except that the cross-sectional shapes of the leg portions 23 and the fin portions 24 are partially different. Therefore, in Embodiment 2 and Embodiment 3, described later, the parts of the fastener element 10 having the same structure as that of Embodiment 1 are denoted by the same reference signs, and the description thereof will be omitted.

[0131] In the manufacturing method of the fastener element 10 of Embodiment 2, the metallic flat plate member 5 similar to the case of the above-described Embodiment 1 is prepared, and the flat plate member 5 is, using a conveying apparatus (not shown), conveyed toward a downstream side (rear) of a conveying direction while

repeating moves and stops.

[0132] Further, with respect to the flat plate member 5 to be intermittently conveyed by the conveying apparatus, the press molding processing of press molding the shape of the coupling head portion 11 of the fastener element 10 is performed (press molding step) in a processing area 2A as in the case with the above-mentioned Embodiment 1. Thereby, as shown in Fig. 18, a head portion molded portion 6 in which the shape of the coupling head portion 11 is molded is serially formed on an upper surface and a lower surface of the flat plate member 5 at a predetermined pitch in a length direction of the flat plate member 5.

[0133] The element part of the flat plate member 5 in which the head portion molded portion 6 is formed is conveyed to a processing area 2B for performing a primary punching processing by an intermittent conveyance of the flat plate member 5. In the processing area 2B, the primary punching step of punching a part of unnecessary parts of the flat plate member 5 is performed.

[0134] In the primary punching step of Embodiment 2, by using a primary punch (not shown) and a primary punching die (not shown) provided with a space part corresponding to the primary punch, right and left outside cut-off parts 8, described later, of the flat plate member 5 is cut off. In Embodiment 2, moves and stops of the element part of the flat plate member 5 in which the head portion molded portion 6 has been formed in the press molding step are repeated twice by the above-mentioned intermittent conveyance, thereafter, the primary punching processing is performed.

[0135] The primary punch (not shown) of Embodiment 2 has a punch tip end portion for performing shear processing on the flat plate member 5. The punch tip end portion of Embodiment 2 is formed to have a cross-sectional shape corresponding to the right and left outside cut-off parts 8 of the flat plate member 5, and strength of the punch tip end portion is appropriately secured. In this case, the right and left outside cut-off parts 8 of the flat plate member 5 is the part disposed on right and left outer sides of the part which is to be the coupling head portion 11 and the tape holding portion 21 of the fastener element 10 in the flat plate member 5, and the part which is punched by the primary punching processing.

[0136] In the primary punching step of Embodiment 2, the above-mentioned primary punch is moved down, and the punch tip end portion is collided with the flat plate member 5 from an upper surface side so as to be along outer side surfaces of the coupling head portion 11 and the tape holding portion 21 to be formed. Thereby, the above-mentioned right and left outside cut-off parts 8 among the unnecessary parts (parts except for the element part) which does not constitute a fastener element 10 is formed in the flat plate member 5 is punched and cut off.

[0137] At this time, the right and left outer side surfaces of the part to be the coupling head portion 11 and the right and left outer side surfaces of the part to be the tape

holding portion 21 in the element part are formed at the same time by the primary punching processing. That is, in Embodiment 2, the right and left outer side surfaces of the fastener element 10 which is disposed from a tip end part (front end part) of the coupling head portion 11 to the tip end part (rear end part) of the fin portion 24 are formed by one step of the primary punching processing. Further, the right and left outside cut-off parts 8 which has been punched from the flat plate member 5 are dropped into a collecting box placed downward of a conveyance pass of the flat plate member 5 to be collected. In Embodiment 2, when the above-mentioned primary punching processing is performed, it is preferable to temporarily hold and fix the flat plate member 5 from the upper and lower direction using a support member (not shown) and a pressing member, for example.

[0138] Next, the element part of the flat plate member 5 in which the right and left outside cut-off parts 8 were cut in the primary punching step is conveyed to a processing area 2C for performing the element punching processing by the intermittent conveyance of the flat plate member 5. In the processing area 2C, the element punching step of punching the fastener elements 10 from the flat plate member 5 is performed. In Embodiment 2, as in the case of the Embodiment 1 described above, moves and stops of the element part on which the primary punching processing has been performed are repeated three times by the intermittent conveyance by the conveying apparatus (not shown), thereafter, the primary punching processing is performed.

[0139] In the element punching processing of Embodiment 2, an element punching die (not shown) for supporting the flat plate member 5, an element punch 50 which is able to be moved up and down with respect to the element punching die as shown in Fig. 19, and a pressing member which is able to be moved up and down (not shown) with respect to the element punching die are used to perform the element punching processing of punching the fastener elements 10 from the flat plate member 5.

[0140] The element punching die of Embodiment 2 supports the element part of the flat plate member 5 in which the primary punching processing has been performed from the lower surface side. The element punching die is provided with a penetrating hole portion having a cross-sectional shape which corresponds to a punch tip end portion 51 and a deformation-preventing protruded portion 52 of the element punch 50 along the upper and lower direction.

[0141] The element punch 50 used in Embodiment 2 has the punch tip end portion 51 which is strongly contacted with a predetermined part of the flat plate member 5 to perform shear processing and the deformation-preventing protruded portion 52 disposed further protruded than a tip end surface of the punch tip end portion 51. The punch tip end portion 51 of the element punch 50 in Embodiment 2 is formed substantially in the same manner as the punch tip end portion 41 of the element punch

40 in Embodiment 1 mentioned above. Further, the punch tip end portion 51 of the element punch 50 is integrally formed to be connected to the deformation-preventing protruded portion 52 disposed outside. Therefore, strength of the punch tip end portion 51 of the Embodiment 2 is also appropriately secured.

[0142] The deformation-preventing protruded portion 52 of Embodiment 2 is disposed to be protruded further than the tip end surface of the punch tip end portion 51. In this case, the protrusion length of the deformation-preventing protruded portion 52 which is protruded from the tip end surface of the punch tip end portion 51 is larger than the thickness dimension of the flat plate member 5. The deformation-preventing protruded portion 52 is, when the element punch 50 is viewed from below, formed continuously along an outer peripheral edge part of the punch tip end portion 51 on right and left outer sides of the punch tip end portion 51.

[0143] The deformation-preventing protruded portion 52 of Embodiment 2 as above is, when the element punch 50 is moved down from above of the flat plate member 5, inserted into the part of the flat plate member 5 where the above-described right and left outside cut-off parts 8 are punched, and contacted or approximated with the right and left outer side surfaces of the fastener element 10 (i.e., right and left outer side surfaces of the coupling head portion 11 and right and left outer side surfaces of the tape holding portion 21), before the punch tip end portion 51 of the element punch 50 is collided with the flat plate member 5. Thereby, when the fastener element 10 is punched from the flat plate member 5 with the element punch 50, the fastener element 10 is supported from the right and left outer side surfaces side, and it is possible to effectively prevent the fastener element 10, particularly the fin portions 24 of the fastener element 10, from being deformed at the time of punching the element.

[0144] The pressing member (not shown) of Embodiment 2 has a pressing surface which is contacted with the upper surface (top surface) of the flat plate member 5 to press the flat plate member 5 from above and a pressing projected portion which is protruded downward from the pressing surface. An insertion hole portion capable of inserting the element punch 50 which moves in the upper and lower direction is formed on the pressing member along the upper and lower direction. The pressing surface of the pressing member is formed to be a flat surface perpendicular to the upper and lower direction. The pressing projected portion of the pressing member is formed substantially in the same manner as the pressing projected portion 62 of the pressing member 60 in the above-mentioned Embodiment 1. Such a pressing member presses the flat plate member 5 from above with a predetermined force, thereby, the pressing member and the element punching die cooperate to fix the flat plate member 5 temporarily so as not to move.

[0145] In the element punching processing of Embodiment 2, the element part of the flat plate member 5 which has been moved to the processing area 2C is pressed

with the pressing member from above, thereby to be held and fixed temporarily with the pressing member and the element punching die with a predetermined force from the upper and lower direction. Subsequently, the element punch 50 is moved down via the insertion hole portion of the pressing member, and the deformation-preventing protruded portion 52 of the element punch 50 is inserted into the right and left outside cut-off parts 8 in the flat plate member 5. Thereafter, the element punch 50 is further moved down, and the punch tip end portion 51 is strongly collided with the upper surface of the flat plate member 5 along an inner side surface (inner peripheral surface) of the tape holding portion 21. Thereby, the fastener element 10 is formed by being punched from the flat plate member 5. At this time, the inner side surface of the tape holding portion 21 in the fastener element 10 is formed by the element punching processing.

[0146] The fastener element 10 punched from the flat plate member 5 by the above-mentioned element punching processing is dropped and collected into the collecting box placed downward of the conveyance pass of the flat plate member 5. The element punching processing as above is performed in accordance with the stop timing of the intermittent conveyance of the flat plate member 5, thereby, a plurality of the fastener elements 10 having the same shape can be manufactured one at a time continuously. On the other hand, the remained part of the flat plate member 5 from which the fastener element 10 was punched is collected by, after releasing the temporary fixing of the flat plate member 5 by the pressing member and the element punching die by moving up of the pressing member, blowing high-pressure air, for example, to be blown out to a collecting apparatus.

[0147] With respect to the plurality of fastener elements 10 of Embodiment 2 manufactured by punching from the flat plate member 5 as described above, thereafter, the polishing treatment, the coating treatment or the plating treatment can be performed as in the case of the above Embodiment 1.

[0148] The fastener element 10 is manufactured using the manufacturing method of Embodiment 2 as above, thereby the same effects as those of the manufacturing method of Embodiment 1 can be obtained.

[0149] Further, the same effects as the fastener element 10 manufactured in the above-described Embodiment 1 can be obtained also in the fastener element 10 manufactured in Embodiment 2.

[0150] In the fastener element 10 of Embodiment 2, in particular, the outer side surfaces and the inner side surfaces of the right and left leg portions 23 and the fin portions 24 are formed by separate steps of punching processing which are the primary punching processing and the element punching processing. Therefore, the right and left leg portions 23 and the fin portions 24 respectively have different characteristic cross-sectional shapes from those of the fastener element 10 of above Embodiment 1, as shown in Fig. 20, for example.

[0151] That is, in the fin portion 24 of Embodiment 1,

the outer side surfaces of the fin portion 24 are formed by moving down the primary punch from above and punching the right and left outside cut-off parts 8 of the flat plate member 5. Therefore, the ridge line portion 24c on the outer peripheral side at the upper end part of the right and left fin portions 24 is formed to have the curved cross-sectional shape so as to be chamfered due to the effect by the flow (dripping) of metal material occurred at the time of the element punching processing. The ridge line portion 24 on the outer peripheral side at the lower end part of the right and left fin portions 24 is, since the primary punching processing is performed in a state that the lower end surface of the fin portion 24 is contacted with the primary punching die (not shown), formed to have the cross-sectional shape that is angular to the outside compared to the ridge line portion 24c on the outer peripheral side at the upper end part.

[0152] On the other hand, the inner side surfaces of the fin portions 24 in Embodiment 2 are formed by moving down the element punch 50 from above and punching the fastener element 10 itself. In the element punching processing, the element punching processing is performed in a state that upper end surfaces of the fin portions 24 are contacted with a tip end surface (lower end surface) of the element punch 50. Therefore, a ridge line portion 24a on the inner peripheral side at the upper end part of the right and left fin portions 24 is formed to have a cross-sectional shape that is angular to the outside of a ridge line portion 24c on the outer peripheral side at the upper end part. A ridge line portion 24b on the inner peripheral side at the lower end part of the right and left fin portions 24 is formed to have a curved cross-sectional shape to be chamfered due to the effect by the flow (dripping) of metal material occurred at the time of element punching processing.

[0153] Since the right and left leg portions 23 and the fin portions 24 have the above-mentioned cross-sectional shapes, also in a case that the polishing treatment and the coating treatment are performed on the manufactured plurality of the fastener elements 10 of Embodiment 2, for example, as in the case of Embodiment 1, the fastener elements 10 can be less likely to be stuck to each other due to capillary phenomenon.

[0154] In the above-mentioned manufacturing method of the fastener element in Embodiment 2, with respect to the element part of the flat plate member 5 which has been moved to the processing area 2C, the element punching processing is performed using the element punch 50 having the deformation-preventing protruded portion 52 as shown in Fig. 19 and the pressing member (not shown), thereby, the fastener element 10 is punched from the flat plate member 5.

[0155] In the present invention, however, as a modification example of Embodiment 2, as in the case of the Embodiment 1, the deformation-preventing protruded portion can be provided on the pressing member instead of the element punch. That is, although not shown in the drawing, it is also possible to perform the element punch-

ing processing to the flat plate member 5 by using the element punch having a shape that the deformation-preventing protruded portion 52 as shown in Fig. 19 is not provided and the pressing member having a deformation-preventing protruded portion which is able to be inserted into the inside cut-off part 7 of the flat plate member 5. Thereby, the same fastener elements 10 as in the case of the above-described manufacturing method of Embodiment 2 can be manufactured.

Embodiment 3

[0156] Fig. 21 is an explanatory view schematically explaining a method for manufacturing a fastener element from a flat plate member in Embodiment 3. Fig. 22 is a cross-sectional view of a fin portion of the fastener element manufactured in Embodiment 3.

[0157] In the manufacturing method of Embodiment 3, a metallic flat plate member 5 is conveyed intermittently in one direction, while three steps of punching processing are serially performed at a predetermined position with respect to the metallic flat plate member 5. Thereby, the fastener element 10 as shown in Figs. 9 to 11 can be manufactured continuously one by one so as to be remained on a conveyance pass of the flat plate member 5. The fastener element 10 manufactured in Embodiment 3 also has the same shape as the fastener element 10 manufactured in Embodiment 1 except for having different cross-sectional shapes of right and left leg portions 23 and fin portions 24.

[0158] In the manufacturing method of the fastener element 10 of Embodiment 3, the same metallic flat plate member 5 as in Embodiment 1 is prepared, and the flat plate member 5 is conveyed toward a downstream side (rearward) of the conveying direction while repeating moves and stops using a conveying apparatus (not shown). With respect to the flat plate member 5 which is conveyed intermittently by the conveying apparatus, the press molding step of molding the shape of a coupling head portion 11 of the fastener element 10 is performed in a processing area 3A for performing the press molding processing as in the case of Embodiment 1. Thereby, as shown in Fig. 21, a head portion molded portion 6 in which the shape of the coupling head portion 11 is molded are serially formed at a predetermined pitch in a length direction of the flat plate member 5 on an upper surface and a lower surface of the flat plate member 5.

[0159] The element part of the flat plate member 5 in which the head portion molded portion 6 is formed is conveyed to a processing area 3B for performing the first step, i.e., a first punching processing by an intermittent conveyance of the flat plate member 5. In the processing area 3B, the first punching step of punching a part of unnecessary parts of the flat plate member 5 (first step) is performed.

[0160] In the first punching processing of Embodiment 3, the same punching processing as in the punching processing of the primary punching step in the above-

mentioned Embodiment 1 is performed. Therefore, in the first punching step of Embodiment 3, an inside cut-off part 7 on an inner side to be surrounded by a tape holding portion 21 of the fastener element 10 in the flat plate member 5 is punched and cut off by the punch. At this time, inner side surface (i.e., each inner side surface of a holding base end portion 22, right and left leg portions 23, and right and left fin portions 24 of the fastener element 10 to be formed) to be the tape holding portion 21 of the element part is formed.

[0161] The element part of the flat plate member 5 on which the first punching processing described above has been performed is conveyed to a processing area 3C for performing the second step, i.e., a second punching processing by the intermittent conveyance of the flat plate member 5. In the processing area 3C, the second punching processing of punching a part of unnecessary parts of the flat plate member 5 (second step) is performed. In Embodiment 3, moves and stops of the element part on which the first punching processing (first step) has been performed are repeated three times by the intermittent conveyance by the conveying apparatus (not shown), thereafter, the second punching processing (second step) is performed.

[0162] In the second punching step of Embodiment 3, the same punching processing as the punching processing of the primary punching step in Embodiment 2 is performed. Therefore, in the second punching step of Embodiment 3, right and left outside cut-off parts 8 in the flat plate member 5 are punched and cut off by the punch. At this time, right and left outer side surfaces to be the coupling head portion 11 and right and left outer side surfaces to be the tape holding portion 21 in the element part are simultaneously formed.

[0163] In the manufacturing method of Embodiment 3, although the right and left outside cut-off parts 8 are punched by the second punching processing (second step), tip end parts (rear end parts) of the fin portions 24 in the element part are held in a state of being connected to the unnecessary part of the flat plate member 5, as shown in Fig. 21. Therefore, even when the first punching processing of forming the inner side surfaces of the fin portions 24 and the second punching processing of forming the outer side surfaces of the fin portions 24 are performed to the flat plate member 5, and strong stress is applied to the element part, it is possible to effectively prevent the fin portions 24 connected to the unnecessary part of the flat plate member 5 from being deformed.

[0164] The element part of the flat plate member 5 on which the second punching processing has been performed is conveyed to a processing area 3D for performing the third punching processing (third step) by the intermittent conveyance of the flat plate member 5. In the processing area 3D, the third punching processing of punching a part of necessary parts of the flat plate member 5 (third step) is performed. In Embodiment 3, moves and stops of the element part on which the second punching processing (second step) has been performed are

repeated three times by the intermittent conveyance by a conveying apparatus (not shown), thereafter, the third punching step (third step) is performed.

[0165] In the third punching step of Embodiment 3, the third punching processing is performed with the punch by punching and cutting off an unnecessary portion 9 remained between the element parts adjacent to each other in the length direction of the flat plate member 5. By the third punching processing, a tip end surface (front end surface) of the coupling head portion 11 of the fastener element 10 to be manufactured and a tip end surface (rear end surface) of the fin portion 24 of the next fastener element 10 adjacent to an upstream side of the fastener element 10 are simultaneously formed. When the third punching processing is performed, it is preferable that the flat plate member 5 is held from the upper and lower direction to be temporary fixed using a support member and a pressing member (not shown), for example.

[0166] The fastener element 10 formed from the flat plate member 5 by the above-mentioned third punching processing is collected by blowing high-pressure air, for example, to be blown out to a collecting apparatus. Furthermore, with respect to the manufactured plurality of the fastener elements 10 of Embodiment 3, it is possible to perform the polishing processing, the coating treatment, the plating treatment, or the like, as in the case of Embodiment 1, afterward.

[0167] By manufacturing the fastener elements 10 using the manufacturing method of Embodiment 3 as described above, substantially the same effects as those of the above-mentioned manufacturing methods of Embodiments 1 and 2 can be obtained.

[0168] Further, the same effects as the fastener elements 10 manufactured in the above-described Embodiments 1 and 2 can be obtained also in the fastener elements 10 manufactured in Embodiment 3.

[0169] In the fastener elements 10 of Embodiment 3, although the outer side surfaces and the inner side surfaces of the right and left fin portions 24 are formed by separate punching processing which are the first punching processing (first step) and the second punching processing (second step), both of the first punching processing and the second punching processing are the punching processing for cutting off the unnecessary parts of the flat plate member 5.

[0170] Therefore, in the fin portions 24 of Embodiment 3 as shown in Fig. 22, a ridge line portion 24a on the inner peripheral side and a ridge line portion 24c on the outer peripheral side at the upper end part of the right and left fin portions 24 are formed to have curved cross-sectional shapes so as to be chamfered due to the effect by the flow (dripping) of metal material generated at the time of element punching processing. A ridge line portion 24b on the inner peripheral side and a ridge line portion 24d on the outer peripheral side at the lower end part of the right and left fin portions 24 are, since each step of the punching processing is performed in a state that lower

end surfaces of the fin portions 24 are contacted with a punching die (not shown), formed to have cross-sectional shapes that are angular to the outside.

Reference Signs List

[0171]

1A, 1B, 1C Processing area	
2A, 2B, 2C Processing area	
3A, 3B Processing area	
3C, 3D Processing area	
5 Flat plate member	
6 Head portion-molded portion	
7 Inside cut-off part	10
8 Outside cut-off part	
9 Remaining unnecessary part	
10 Fastener element	
11 Coupling head portion	
12 Flat plate portion	15
13 Central projecting portion	
14 Coupling convex portion	
15 Raised portion	
16 Insertion groove portion	
17 Insertion concave portion	
20 Step portion	
21 Tape holding portion	
22 Holding base end portion	
23 Leg portion	
24 Fin portion	20
24a Ridge line portion on inner peripheral side at upper end part	
24b Ridge line portion on inner peripheral side at lower end part	
24c Ridge line portion on outer peripheral side at upper end part	25
24d Ridge line portion on outer peripheral side at lower end part	
28 Fastener stringer	
29 Fastener tape	30
30 Molding punch	
31 Pressing portion	
32 Press tip end surface	
33 First concave portion	
34 Second concave portion	35
35 Third concave portion	
40, 40 Element punch	
41, 41a Punch tip end portion	
42 Deformation-preventing protruded portion	
43 Front-side punching portion (Head portion-side punching portion)	40
44 Rear-side punching portion (Holding portion-side punching portion)	
45 Step portion	
46 First concave portion	45
47 Second concave portion	
48 Third concave portion	
49 Enter-permitting hole portion	50

50 Element punch	
51 Punch tip end portion	
52 Deformation-preventing protruded portion	
60, 60a Pressing member	
61, 61a Pressing surface	
62, 62a Pressing projected portion	
63, 63a Insertion hole portion	
64 Deformation-preventing protruded portion	
80 Element punching die	
W1 Dimension in element width direction of fin portion	
W2 Dimension in element width direction of leg portion	

Claims

1. A manufacturing method of a fastener element for manufacturing a metallic fastener element (10) comprising a coupling head portion (11) and a tape holding portion (21) extending in one direction from the coupling head portion (11), wherein the tape holding portion (21) comprises a holding base end portion (22) connecting to the coupling head portion (11), a pair of leg portions (23) branching and extending to right and left from the holding base end portion (22), and right and left fin portions (24) extending from a tip end part of each leg portion (23) and formed to be thinner than the leg portion (23) in a plan view by performing punching processing to a long metallic flat plate member (5), being **characterized in that** the method including:

performing at least two steps of the punching processing, and
performing one step of the punching processing along right and left outer side surfaces of the coupling head portion (11) and right and left outer side surfaces of the tape holding portion (21) to be formed.

2. The manufacturing method of the fastener element according to claim 1, the method including performing the punching processing of punching a part of the flat plate member (5) along the right and left outer side surfaces of the tape holding portion (21) and the punching processing of punching a part of the flat plate member (5) along an inner side surface of the tape holding portion (21) separately.

3. The manufacturing method of the fastener element according to claim 1 or 2, the method including:

cutting off a part of unnecessary parts (7, 8) from the flat plate member (5) by performing primary punching processing of punching the part of the unnecessary parts (7, 8) which does not constitute the fastener element (10) of the flat plate

- member (5) as the punching processing, and punching the fastener element (10) from the flat plate member (5) by performing element punching processing with respect to the flat plate member (5) on which the primary punching processing has been performed as the punching processing.
4. The manufacturing method of the fastener element according to claim 3, the method including cutting off an inside cut-off part (7) disposed inside the tape holding portion (21) among the unnecessary parts of the flat plate member (5) by performing the primary punching processing.
 5. The manufacturing method of the fastener element according to claim 3, the method including cutting off an outside cut-off part (8) disposed outside in a width direction of the fastener element among the unnecessary parts of the flat plate member (5) by performing the primary punching processing.
 6. The manufacturing method of the fastener element according to any one of claims 3 to 5, the method including using a die (80) for supporting the flat plate member (5), a pressing member (60, 60a) disposed to be able to move up and down with respect to the die (80) and pressing and fixing the flat plate member (5) between the die (80), and an element punch (40, 40a, 50) disposed to be able to move up and down with respect to the die (80) and punching the fastener element (10) from the flat plate member (5) fixed between the die (80) and the pressing member (60, 60a) in the element punching processing.
 7. The manufacturing method of the fastener element according to claim 6, being **characterized in that**:

the element punch (40, 50) has a punch tip end portion (41, 51) contacting with the flat plate member (5) to punch the fastener element (10), and a deformation-preventing protruded portion (42, 52) disposed to be protruded further than a tip end surface of the punch tip end portion (41, 51) and preventing deformation of the fastener element by being inserted into a cut-off part which has been punched out as the unnecessary parts of the flat plate member (5) in the primary punching processing, and the pressing member (60) has a pressing surface (61) contacting with an upper surface of the flat plate member (5) to press the flat plate member (5).
 8. The manufacturing method of the fastener element according to claim 6, being **characterized in that** the element punch (40a) has a punch tip end portion (41a) contacting with the flat plate member (5) to punch the fastener element (10), and the pressing member (60a) has a pressing surface (61a) contacting with an upper surface of the flat plate member (5) to press the flat plate member (5), and a deformation-preventing protruded portion (64) disposed protruded further than the pressing surface (61a) and preventing deformation of the fastener element by being inserted into a cut-off part which has been punched out as the unnecessary parts of the flat plate member (5) in the primary punching processing.
 9. The manufacturing method of the fastener element according to claim 1 or 2, the method including forming the fastener element (10) by performing a plurality steps of the punching processing of punching a part of unnecessary parts (7, 8, 9) of the flat plate member (5) which does not constitute the fastener element (10) as the punching processing.
 10. The manufacturing method of the fastener element according to any one of claims 1 to 9, the method including performing press molding processing of molding a shape of the coupling head portion (11) of the fastener element (10) on the flat plate member (5) before performing the punching processing.

FIG.1

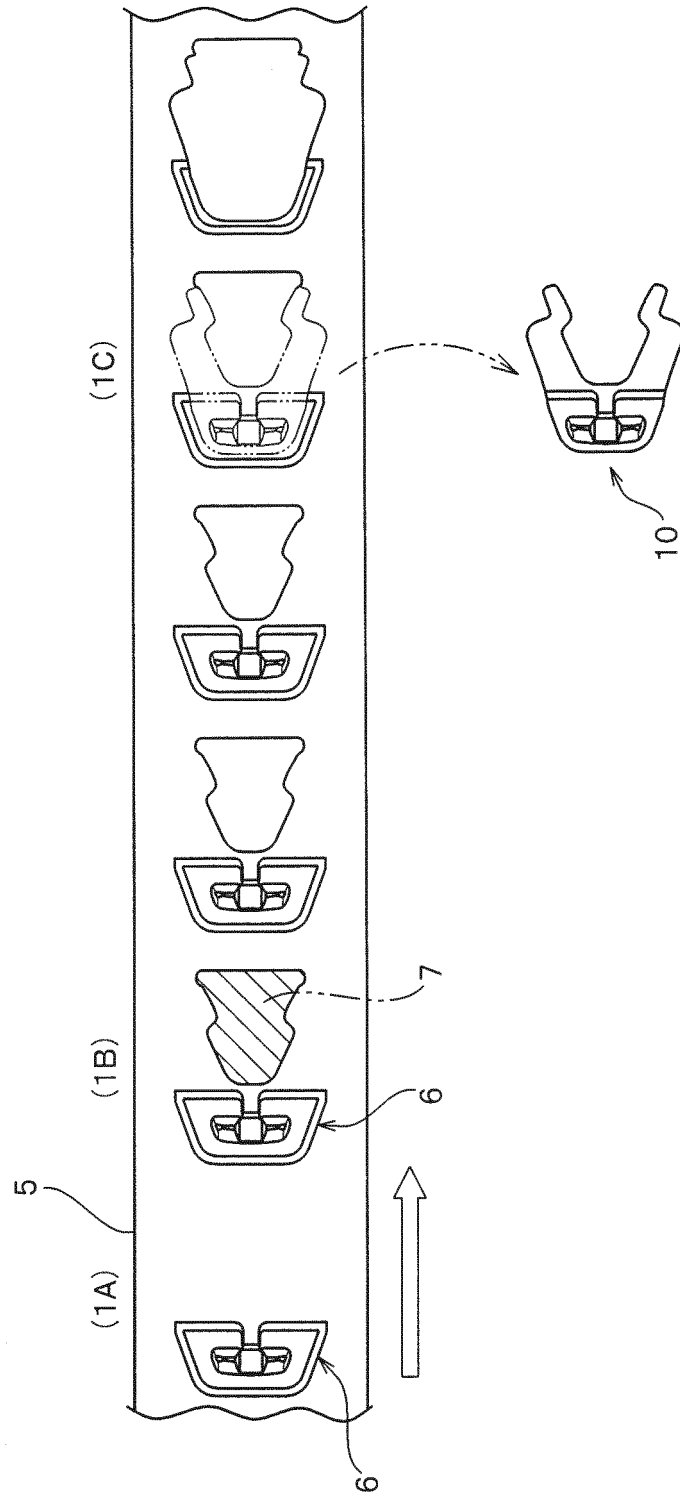


FIG. 2

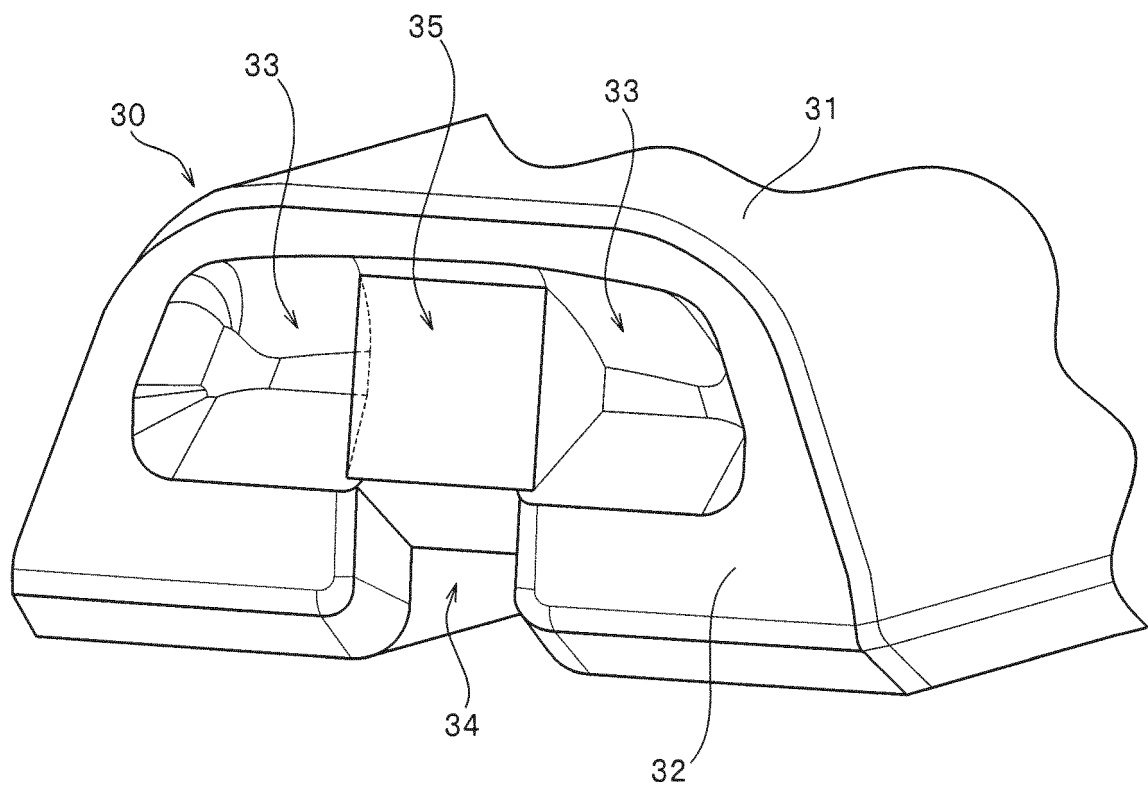


FIG. 3

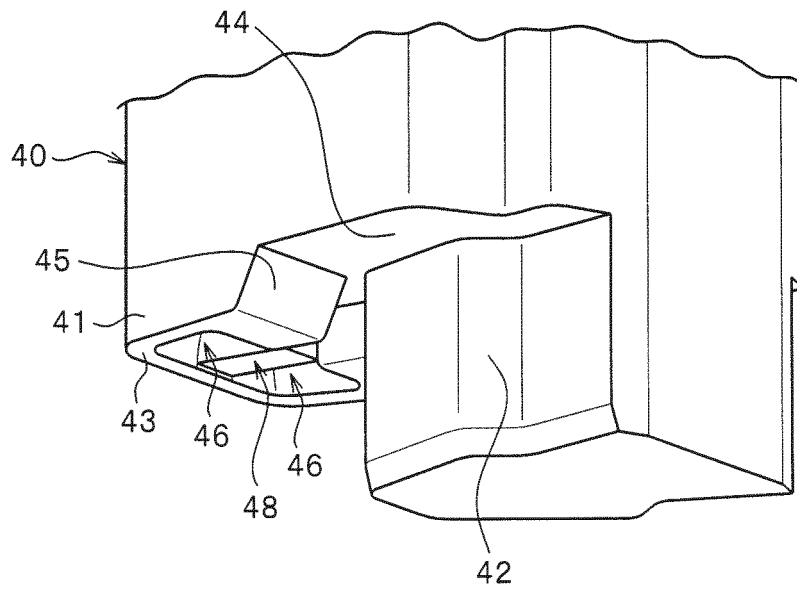


FIG. 4

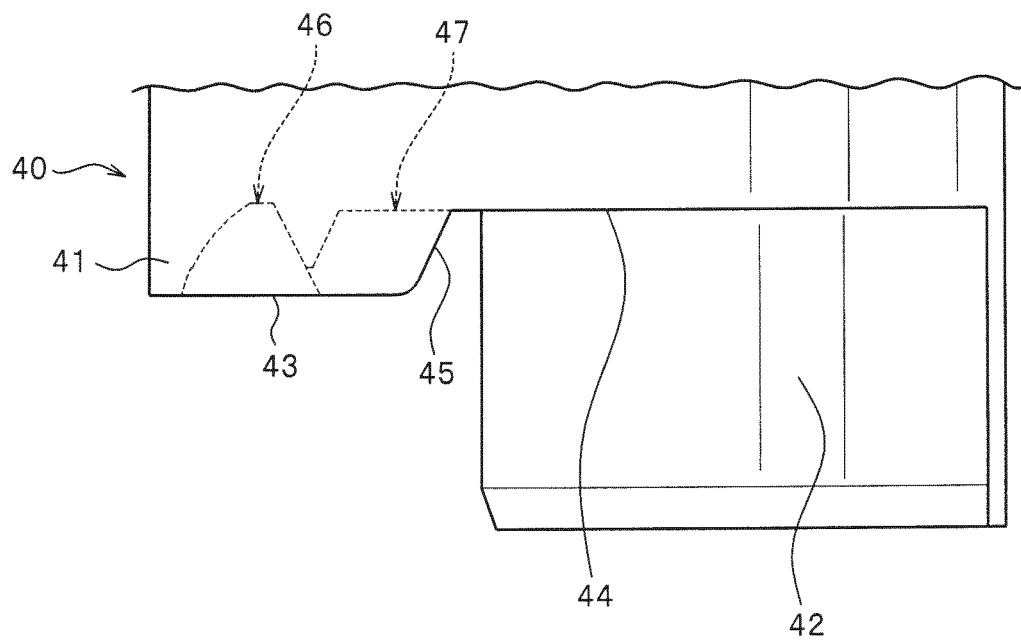


FIG. 5

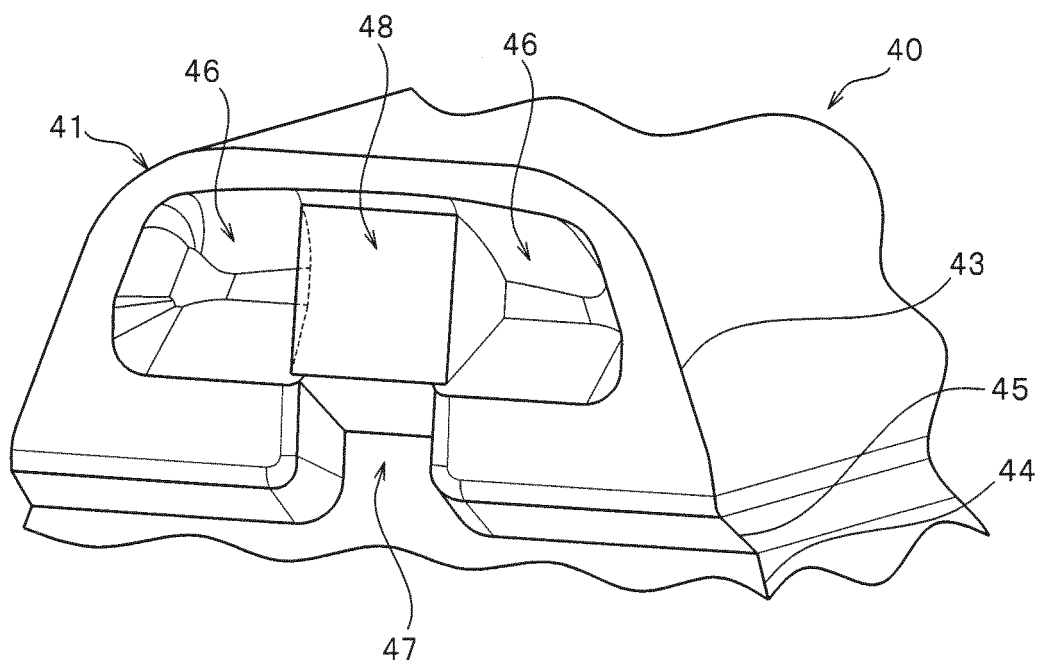


FIG. 6

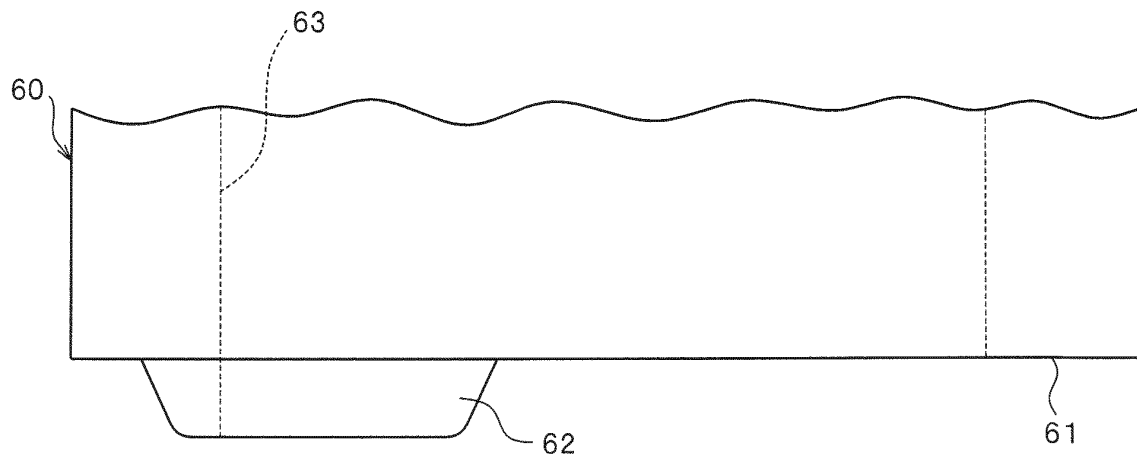


FIG. 7

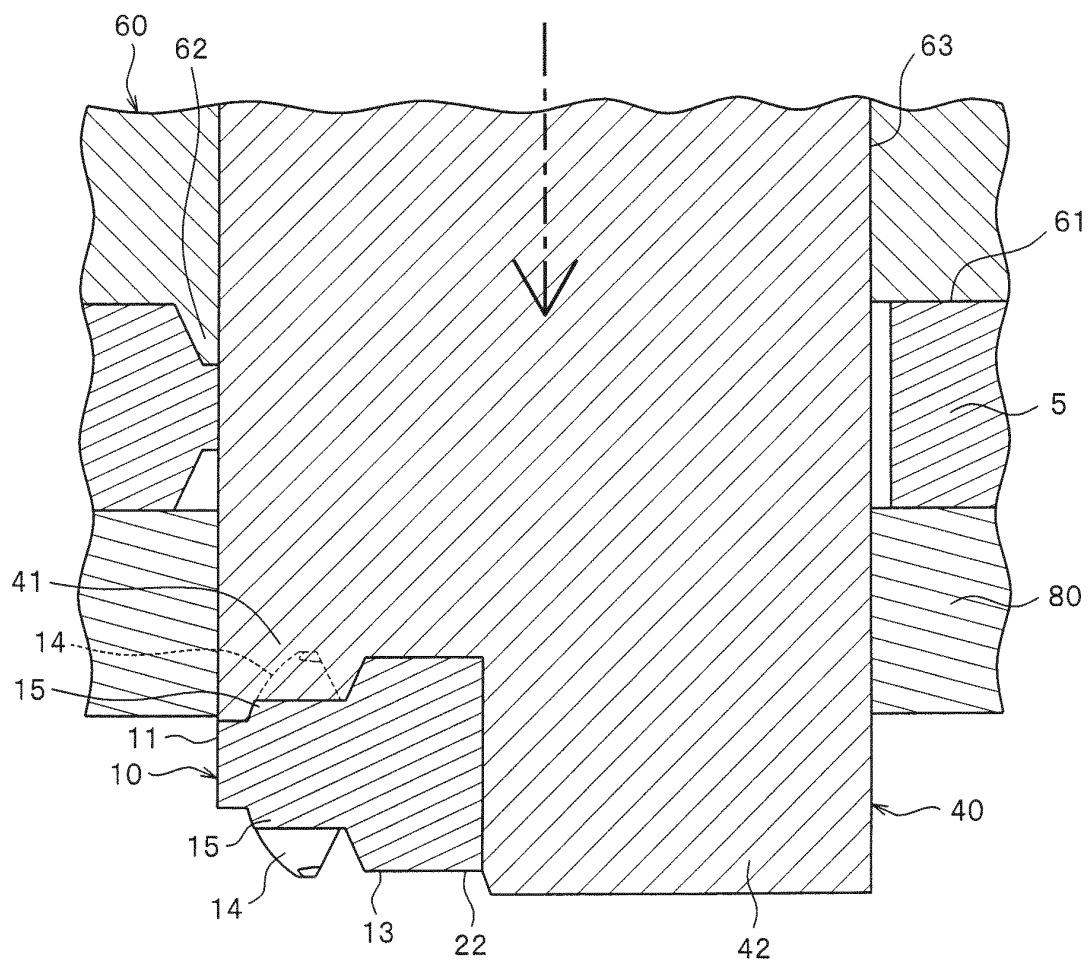


FIG. 8

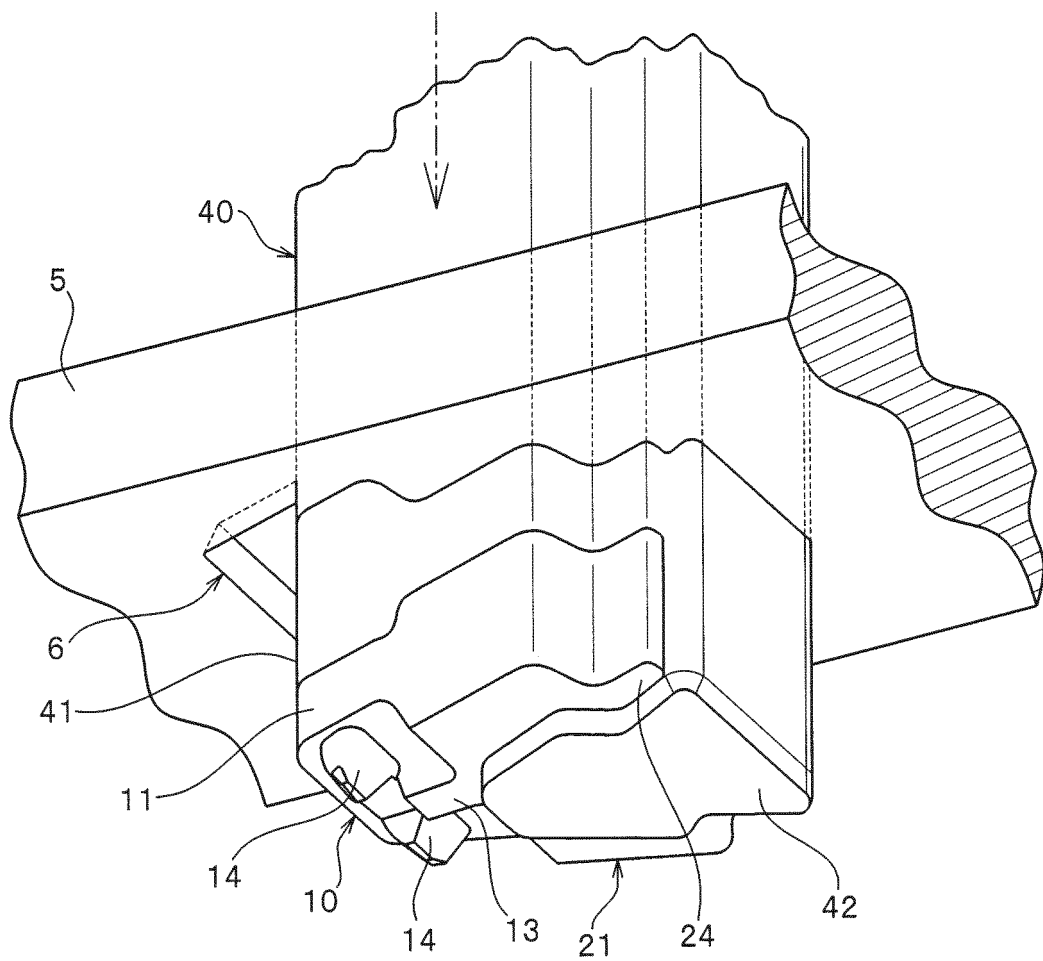


FIG. 9

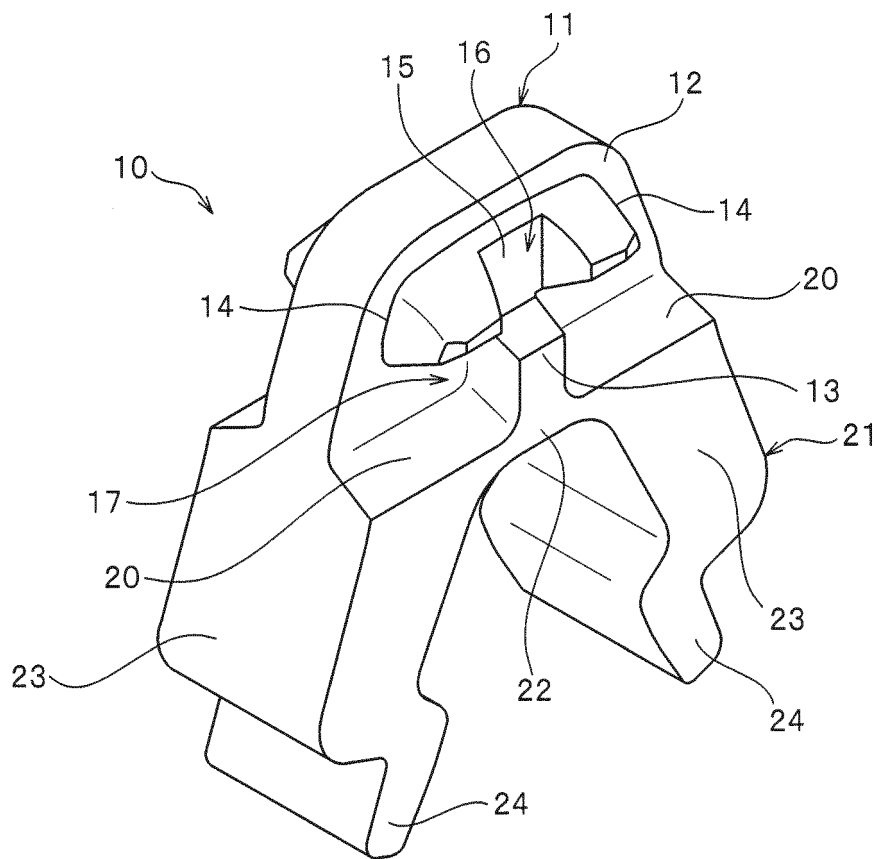


FIG.10

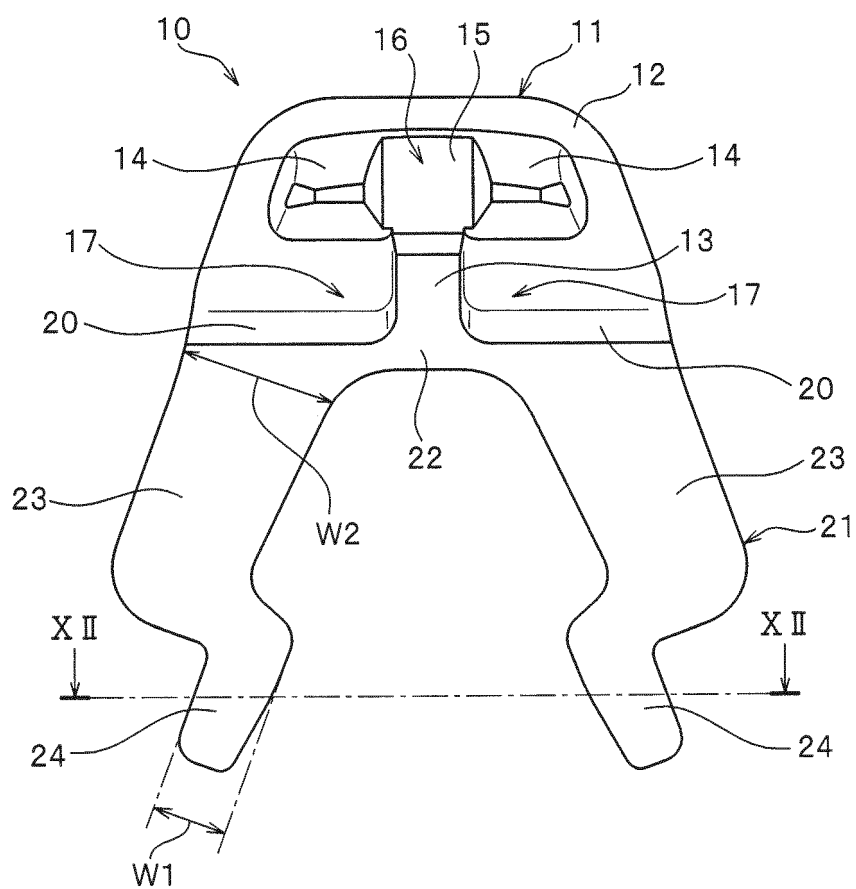


FIG.11

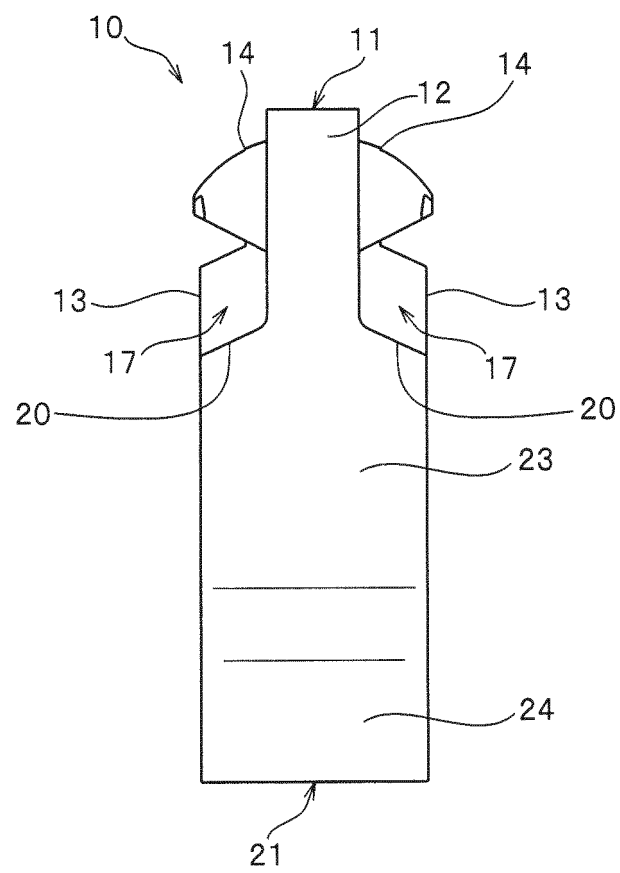


FIG.12

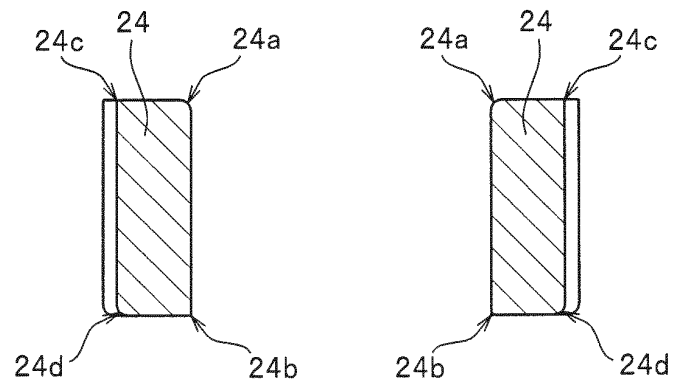


FIG.13

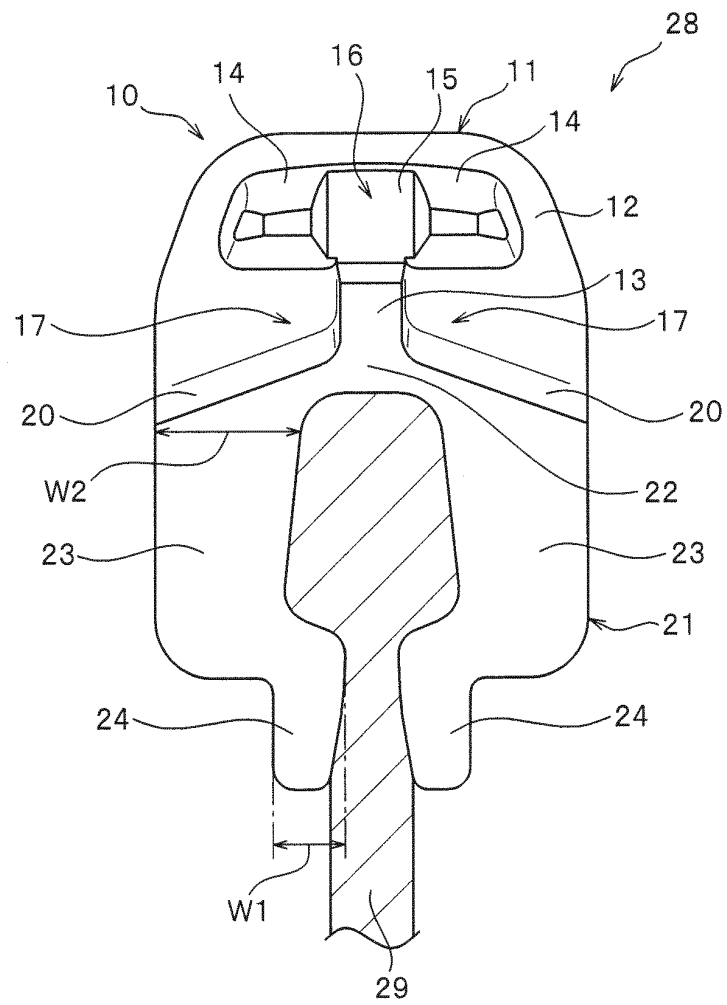


FIG.14

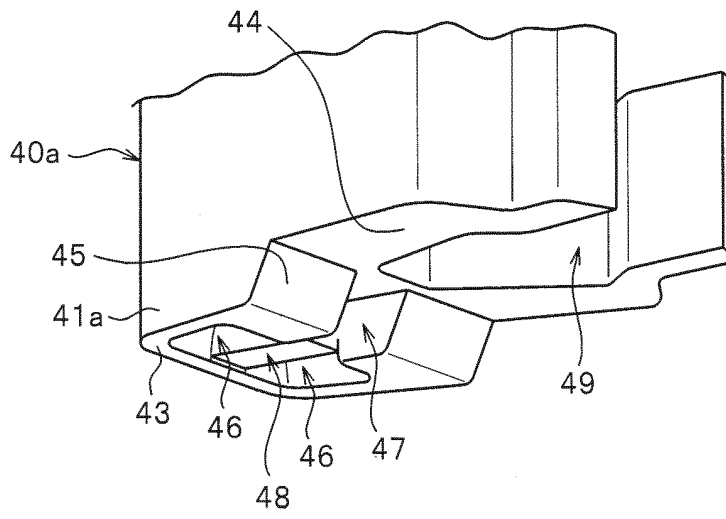


FIG.15

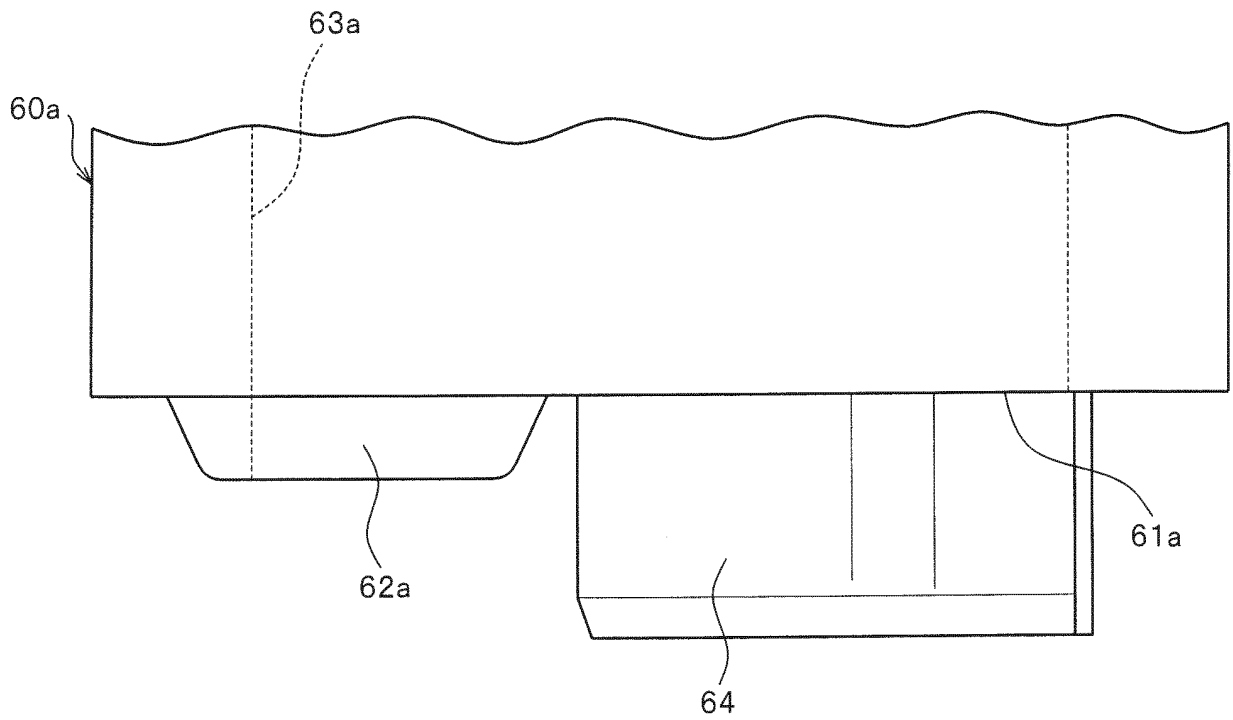


FIG.16

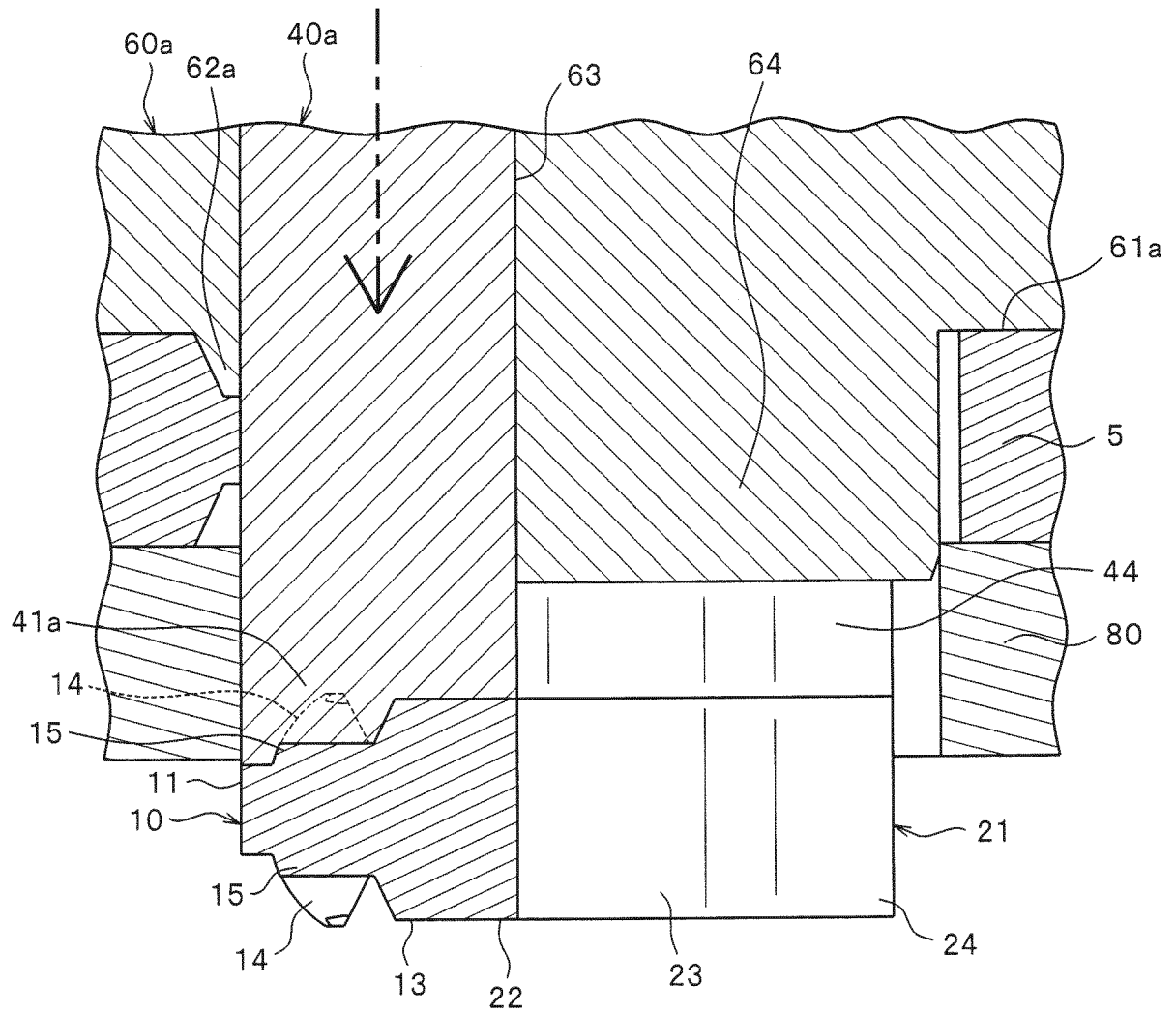


FIG.17

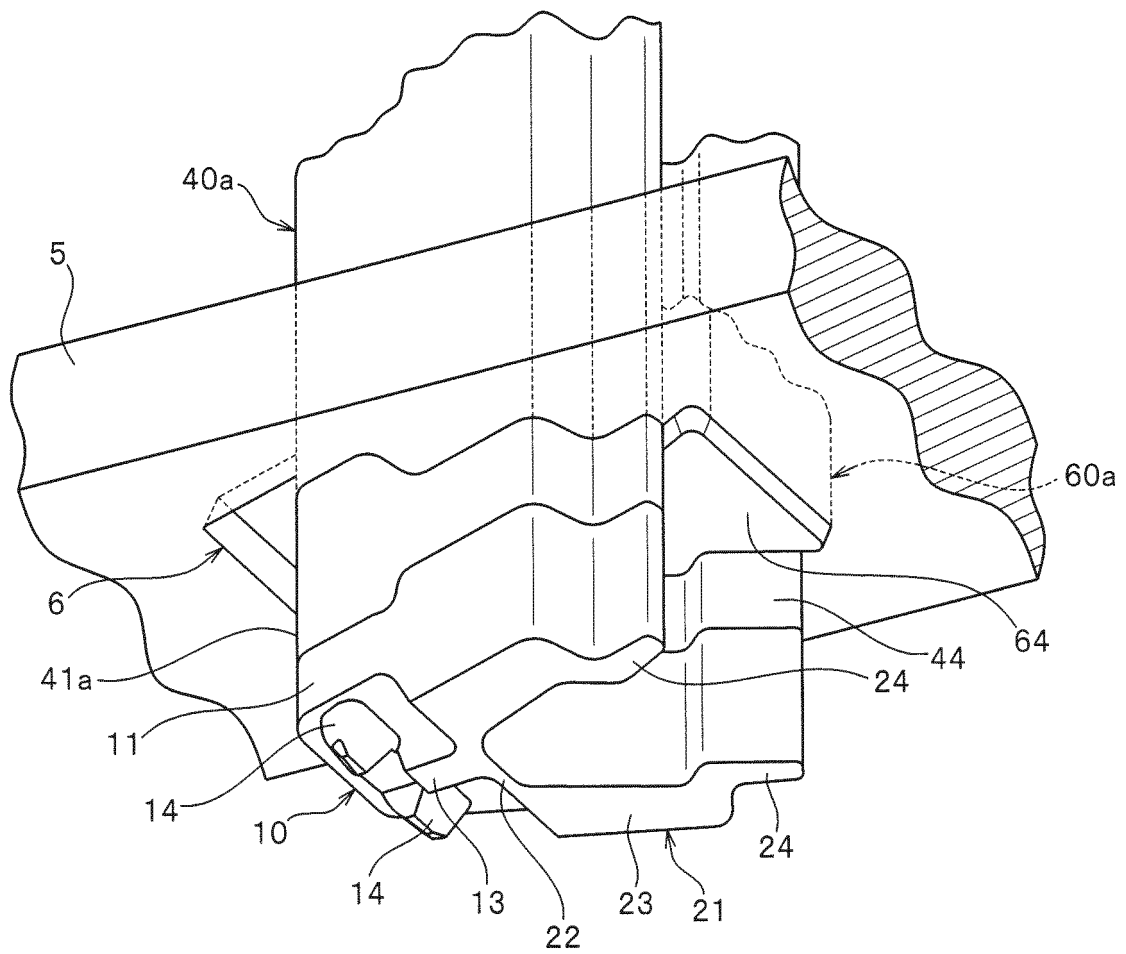


FIG.18

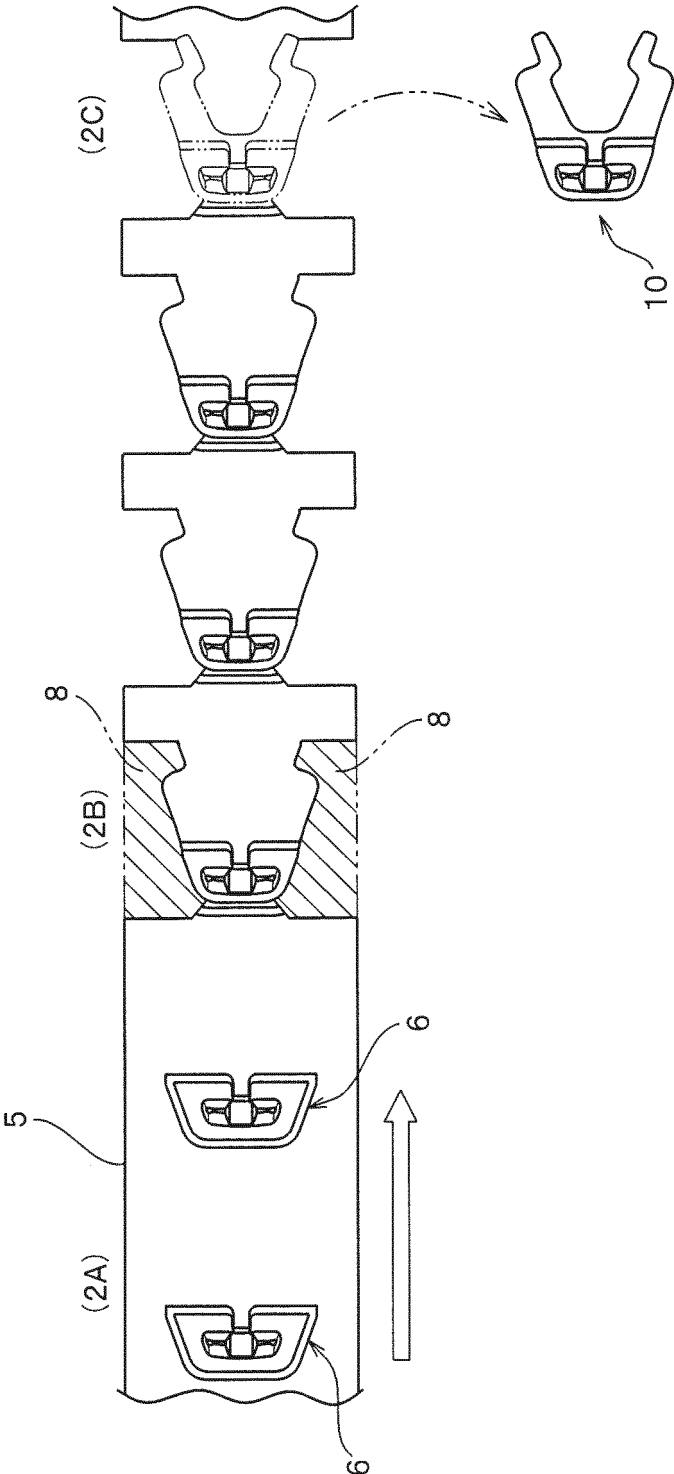


FIG.19

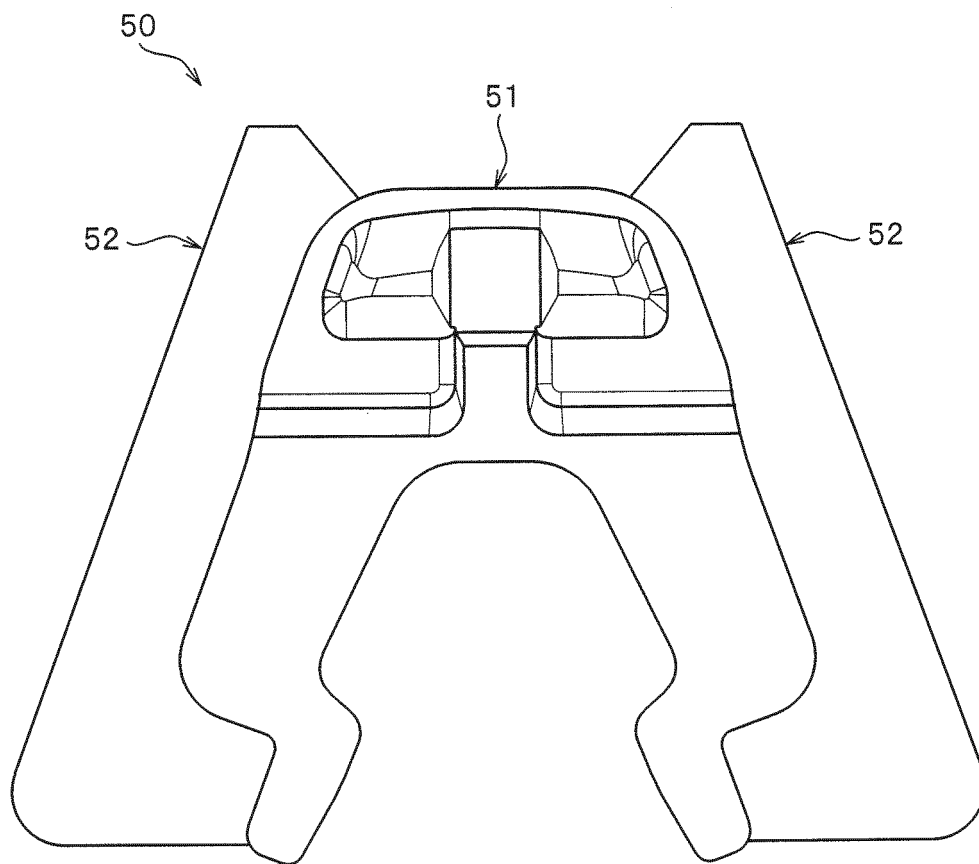


FIG. 20

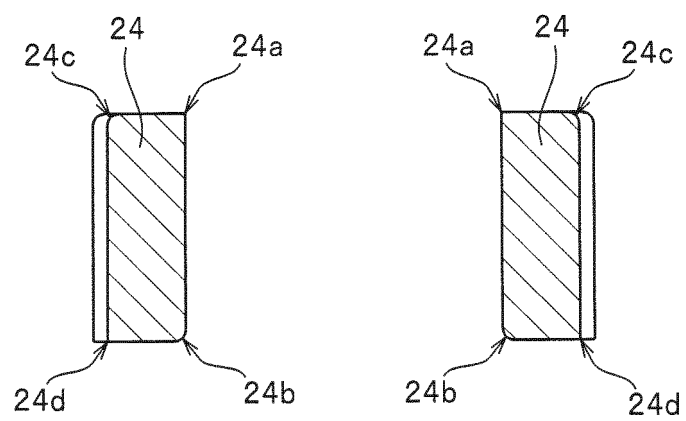


FIG. 21

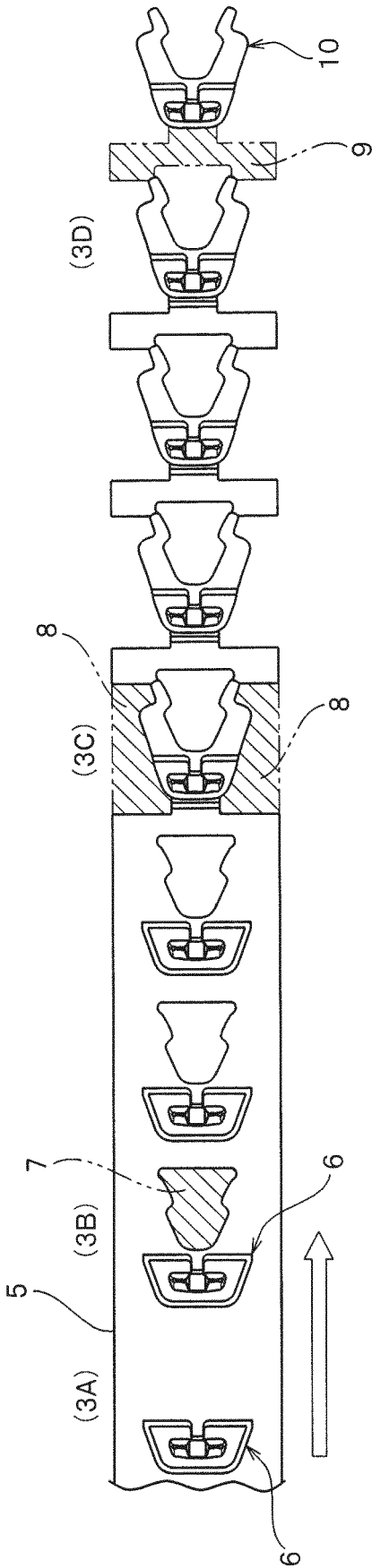


FIG. 22

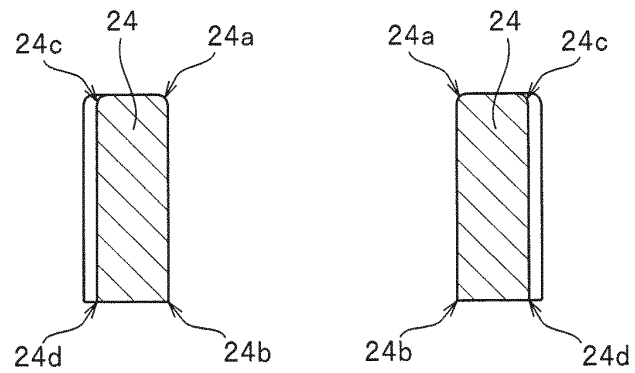


FIG. 23

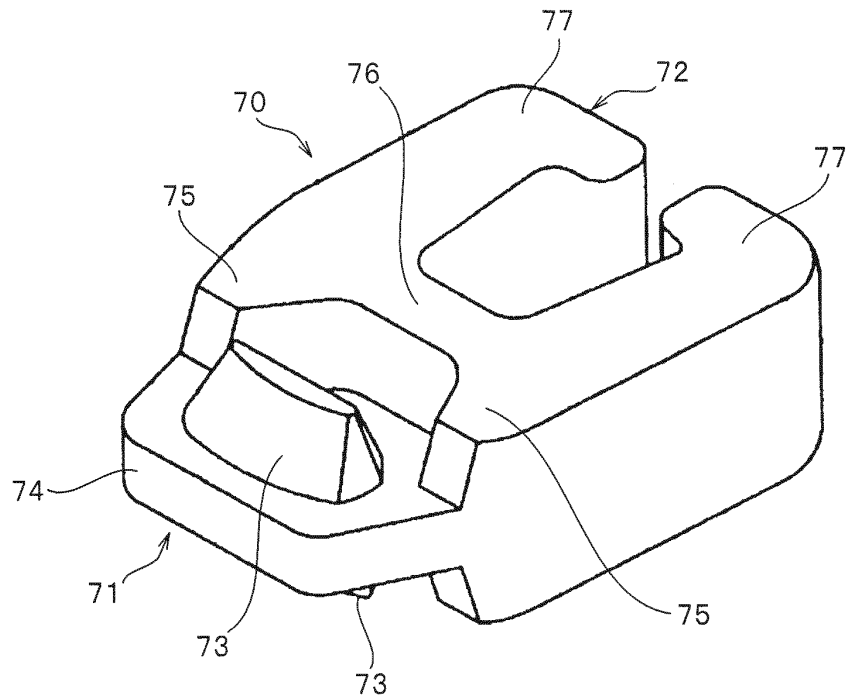
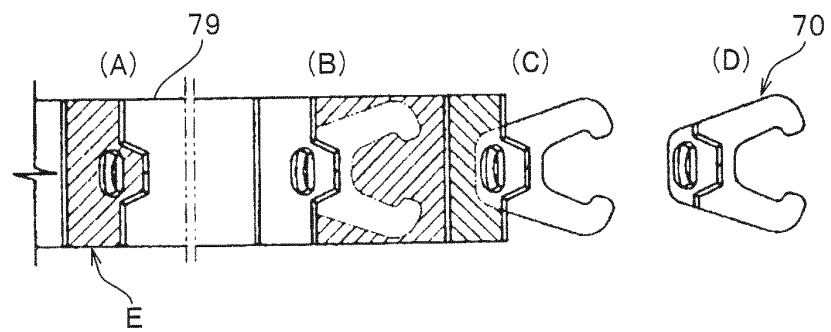


FIG. 24



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2017/040807

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. B21D53/52 (2006.01) i, B21D28/00 (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)

Int.Cl. B21D53/52, B21D28/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2018

Registered utility model specifications of Japan 1996-2018

Published registered utility model applications of Japan 1994-2018

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.
Y	US 1947956 A (HOOKLESS FASTENER COMPANY) 20 February 1934, page 1, line 109 to page 4, line 133, fig. 1-5 (Family: none)	1-10
Y	WO 2013/051149 A1 (YKK CORPORATION) 11 April 2013, paragraphs [0066]-[0090], fig. 2, 3 & CN 103027447 A & TW 201318575 A1 & KR 10-2014-0056386 A & EP 2764790 A1 & US 2015/0033512 A1, paragraphs [0088]-[0113], fig. 2, 3	1-10
Y	JP 39-11691 B1 (YOSHIDA KOGYO KK) 25 June 1964, page 1, left column, line 18 to right column, line 20, fig. 6-8 (Family: none)	1-10



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

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
31.01.2017Date of mailing of the international search report
13.02.2018Name 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/JP2017/040807

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 2017-005945 A (TOYOTA BOSHOKU CORPORATION) 05 January 2017, paragraphs [0019]-[0023], fig. 8-12 & US 2016/0361745 A1, paragraphs [0032]-[0036], fig. 8-12 & DE 102016110795 A1 & CN 106391821 A	6-10 1-5

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 4215660 A [0002]
- JP 4215660 B [0011]