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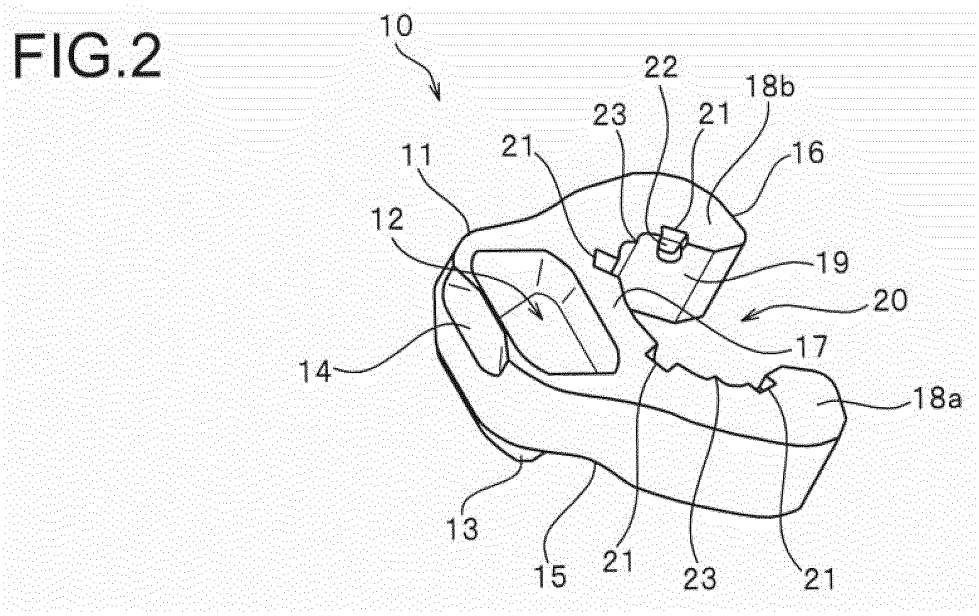
(54) **FASTENER ELEMENT, MANUFACTURING DEVICE FOR FASTENER ELEMENT, AND MANUFACTURING METHOD FOR FASTENER ELEMENT**

(57) This fastener element (10) has a coupling head portion (11) and a tape holding portion (16) provided with a body portion (17), a first leg portion (18a), and a second leg portion (18b). The tape holding portion (16) has at least one notch portion (21) that is open on a tape holding surface (19), and a bulging portion (22) that bulges out adjacently with respect to a bottom surface (21a) in the element thickness direction of the notch portion (21). Such a fastener element (10) can be easily manufactured from a Y-shaped wire material (50). Furthermore, the slip strength and pull-out strength of the fastener element (10) can be increased by implanting the fastener element (10) in a fastener tape (3).

FIG.2



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Description

Technical Field

[0001] The present invention relates to a metallic fastener element having a coupling head portion in which a coupling concave portion is formed on a first surface and a coupling convex portion is formed on a second surface, and a manufacturing device and a manufacturing method for the fastener element.

Background Art

[0002] A metallic fastener element (hereinafter, also simply referred to as a metal element) generally has a coupling head portion and a tape holding portion extending from a base end part of the coupling head portion. The tape holding portion has a body portion extending continuously from the coupling head portion and a pair of first leg portion and a second leg portion branched and further extending from the body portion. In this case, a tape holding space is formed between the first leg portion and the second leg portion, and at the same time, a tape holding surface is formed continuously from the first leg portion to the second leg portion via the body portion of the tape holding portion. Such a metal element is generally manufactured using the following two major methods.

[0003] The first method for manufacturing a metal element is that a metallic flat rectangular wire material is plastically deformed by pressing by press process and the like to mold a coupling head portion and others, and the molded rectangular wire material is punched or cut into an element shape using a punch, a die or the like. In this first manufacturing method, each fastener element is manufactured in a separate state.

[0004] The fastener elements thus obtained are subjected to a polishing step such as a barrel polishing, a chemical polishing or the like, and a coating step of applying a clear coating or the like to an element surface, and then, they are respectively implanted at one side edge part of a fastener tape at constant intervals by using a crimping means. Thereby, a fastener stringer in which a plurality of the metal elements are lined up on the fastener tape is manufactured.

[0005] Next, the second manufacturing method for manufacturing a metal element is that a long metal wire material having a circular cross section is passed through a plurality of rolls and molded to have a substantially Y-shaped lateral cross section, thereby an element-use wire material (so-called a Y-bar) having a substantially Y-shaped lateral cross section is produced. Then, the obtained wire material is cut sequentially at a desired thickness in a length direction of the wire material by using a cutting punch and a cutting die, thereby an element component having a provisional coupling head portion and a tape holding portion extending from the provisional coupling head portion is formed.

[0006] Thereafter, the provisional coupling head portion of the obtained element component is press-molded from the first surface side in an element thickness direction using a forming die and a forming punch to be plastically deformed. Thereby, a metal element having a coupling head portion in which a coupling concave portion is formed on the first surface and a coupling convex portion is formed on the second surface, and the tape holding portion extending from the coupling head portion is manufactured.

[0007] Examples of the second manufacturing method as above and manufacturing devices therefor are described in Japanese patent publication S63-6295B (Patent Document 1), Japanese Patent publication JP2,744,383 (Patent Document 2) and International publication WO2015/049767 A1(Patent Document 3) and the like.

[0008] The metal element manufactured by the second manufacturing method as above is sometimes called as a one-surface element because one coupling concave portion and one coupling convex portion are respectively formed on opposite surfaces of the coupling head portion. The one-surface elements manufactured by the second method are respectively attached sequentially to one side edge part of the fastener tape by an implanting step at a crimping part (crimping punch) continuously after the coupling convex portion and the coupling concave portion are molded as above, thereby a fastener stringer is manufactured. Further, before the implanting step to the fastener tape, the manufactured one-surface elements may undergo a polishing step such as a barrel polishing, if necessary.

[0009] The second manufacturing method for manufacturing the metal element from the wire material having a substantially Y-shaped cross section as above has an advantage that fastener stringers and slide fasteners can be manufactured at a low cost although a shape of the fastener element is restricted compared with the first manufacturing method of manufacturing metal elements from a metallic flat rectangular wire material.

[0010] Meanwhile, for the metal element having the coupling head portion and the tape holding portion, a high pull-out strength showing a strength that the metal element does not remove from the fastener tape when receiving a force in a tape width direction of the fastener tape, a high slip strength showing a strength that the metal element does not move from its attached position when receiving a force in a tape length direction, and the like are generally required.

[0011] Examples of inventions regarding enhancing slip strength of the metal element are disclosed in Japanese Utility Model Application Publication JPS52-64106 (Patent Document 4), Utility Model Publication JPS56-35052 (Patent Document 5), Utility Model Publication JPS57-48405 (Patent Document 6) and others.

[0012] As shown in a perspective view of the metal element 90 of Patent Document 6 in Fig. 13 as an example, the metal element 90 of Patent Document 6 is provided with a plurality of protruded portions 93 protruding

from the tape holding surface 92 of the tape holding portion 91 in an orthogonal direction to the element thickness direction so as to bulge locally toward a holding space holding the fastener tape.

[0013] The metal element 90 is attached (implanted) to the fastener tape generally by, in a state that the fastener tape is inserted into the tape holding portion 91, pressing and plastically deforming the first leg portion 94a and the second leg portion 94b of the tape holding portion 91 so as to approach each other.

[0014] Therefore, since a plurality of protruded portions 93 are provided at the tape holding portion 91 of the metal element 90 as above, the protruded portion 93 can be locally dug into the fastener tape when the metal element 90 is attached to the fastener tape. As a result, the above-mentioned slip strength of the metal element 90 with respect to the fastener tape as above can be effectively enhanced.

Prior Art Document

Patent Documents

[0015]

Patent Document 1: JP S63-6295 B
Patent Document 2: JP 2,744,383
Patent Document 3: WO2015/049767 A1
Patent Document 4: JPU S52-64106 A
Patent Document 5: JPU S56-35052 B
Patent Document 6: JPU S57-48405 B

Summary of Invention

Problems to be Solved by the Invention

[0016] As mentioned above, generally known methods for manufacturing a metal element are the first manufacturing method manufacturing from a metallic rectangular wire material and the second manufacturing method manufacturing from a wire material having a substantially Y-shaped cross section (Y-bar). In a case of using the second manufacturing method, the metal element is manufactured by conducting a press molding to the element component cut out of the Y-bar in the element thickness direction, as mentioned above.

[0017] However, in a case of manufacturing the conventional metal element 90 as shown in Fig. 13, for example, it is required that a plurality of protruded portions 93 are protruded in a direction orthogonal to the element thickness direction at the tape holding portion 91 of the metal element 90. Therefore, it has been extremely difficult to manufacture the metal element 90 having a plurality of protruded portions 93 using the conventional second manufacturing method in which the provisional coupling head portion can be press-processed only along the element thickness direction.

[0018] Meanwhile, in a case of manufacturing the metal element 90 as shown in Fig. 13 using the conventional first manufacturing method, the tape holding portion of the manufactured metal element can be press-processed from a direction orthogonal to the element thickness direction, too. Therefore, it is possible that the protruded portions 93 are formed so as to protrude from the tape holding surface 92. In this case, however, it is difficult to secure a large bulging height (protruding amount) of the protruded portions 93 from the tape holding surface 92 of the tape holding portion 91.

[0019] Therefore, when a polishing step is conducted to the metal element manufactured from a metallic flat rectangular wire material, the protruded portion provided at the tape holding portion of the metal element may be scraped in the polishing step to be extremely small or be disappeared, in some cases. For this reason, also in a case of polishing after manufacturing the fastener element, a development in technology that the protruded portion can be formed in an appropriate size at the tape holding portion of the fastener element, and a slip strength can be stably enhanced is required.

[0020] The present invention has been made in view of the above conventional problems to be solved, and its specific objective is to provide a metallic fastener element in which a protruded portion stably having a bulging height which enables to enhance a slip strength is provided at the tape holding portion, and which can be manufactured at a low cost using a method of cutting an element component out of a wire material having a substantially Y-shaped cross section, and a manufacturing device and a manufacturing method of the fastener element.

Means for Solving the Problems

[0021] In order to achieve the above objective, a fastener element provided by the present invention is, as a basic configuration, a metallic fastener element for a slide fastener and has a coupling head portion and a tape holding portion extending from the coupling head portion in which a coupling concave portion is concaved on a first surface of the coupling head portion, a coupling convex portion is protruded on a second surface of the coupling head portion, the tape holding portion has a body portion extending from the coupling head portion and a pair of first leg portion and second leg portion branched and further extending from the body portion, and a tape holding surface is continuously formed from the first leg portion to the second leg portion via the body portion, in which the tape holding portion has at least one notch portion concaved on at least one surface of the first surface and the second surface of the tape holding portion along an element thickness direction and open on the tape holding surface, and a bulging portion adjacent to a bottom surface of the notch portion in an element thickness direction and bulging from the tape holding surface, as a most principal feature.

[0022] In the fastener element according to the present

invention, it is preferable that the bottom surface of the notch portion and a tip end surface of the bulging portion are formed to be a continuous single surface.

[0023] Further, it is preferable that the notch portion is formed in a tapered shape so that a cross-sectional area of a space orthogonal to the element thickness direction gradually becomes smaller toward the bottom surface of the notch portion.

[0024] Furthermore, it is preferable that a plurality of the notch portions and a plurality of the bulging portions are formed symmetrically about a center surface in the element width direction.

[0025] In the fastener element of the present invention, it is preferable that the tape holding portion has protruded rib portions protruded on the tape holding surface continuously along the element thickness direction.

[0026] It is also preferable that the notch portion is concaved on the first surface of the tape holding portion.

[0027] Next, a manufacturing device of the fastener element provided by the present invention has, as a basic structure, a wire material supply part supplying an element-use wire material having a substantially Y-shaped lateral cross section intermittently at predetermined pitches along a length direction, a cutting punch cutting the element-use wire material at a predetermined thickness and forming an element component having a provisional coupling head portion and a tape holding portion extending from the provisional coupling head portion, and an element molding part press-molding the provisional coupling head portion of the element component to mold a coupling concave portion on a first surface of the provisional coupling head portion and to mold a coupling convex portion on a second surface of the provisional coupling head portion, in which the element molding part has a protruded pressing part forming a notch portion concaved at the tape holding portion of the element component by locally pressing the tape holding portion from the first surface along the element thickness direction to be plastically deformed, and a bulging portion bulging adjacent to the bottom surface of the notch portion by plastic flow along with formation of the notch portion, as a most principal feature.

[0028] In the manufacturing device of the present invention, it is preferable that the element molding part has a forming die on which the element component is placed, a pressure pad disposed to be able to move up and down with respect to the forming die and pressing and holding the tape holding portion of the element component toward the forming die, and a forming punch disposed to be able to move up and down with respect to the forming die and press-molding the provisional coupling head portion of the element component held between the forming die and the pressure pad, in which the pressure pad has a component holding part pressing and holding the tape holding portion of the element component with the tip end surface, and an insertion part hanging from the tip end surface of the component holding part and inserted between the first leg portion and the second leg portion of the tape holding portion, and the protruded pressing part is protruded on a base end part of the insertion part in the pressure pad from an outer peripheral side surface of the insertion part.

[0029] In this case, the protruded pressing part of the pressure pad has a shape such that a cross-sectional area orthogonal to the hanging direction of the insertion part is decreased with distance from the tip end surface of the component holding part.

[0030] Next, a manufacturing method of a fastener element provided by the present invention is a method including: forming an element component having a provisional coupling head portion and a tape holding portion extending from the provisional coupling head portion by cutting an element-use wire material having a substantially Y-shaped lateral cross section with a predetermined thickness, and molding a coupling concave portion on a first surface of the provisional coupling head portion and molding a coupling convex portion on a second surface of the provisional coupling head portion by conducting a press molding to the provisional coupling head portion of the element component, and the method further includes: forming a notch portion which is concaved on the tape holding portion by locally pressing the tape holding portion of the element component from the first surface along the element thickness direction to be plastically deformed when holding the tape holding portion of the element component in the press molding of the provisional coupling head portion, and at the same time, forming a bulging portion which is bulged adjacent to a bottom surface of the notch portion by plastic flow along with formation of the notch portion, as a most principal feature.

Effects of the Invention

[0031] In the fastener element of the present invention, the tape holding portion extending from the coupling head portion has the tape holding surface formed continuously from the first leg portion to the second leg portion via the body portion of the tape holding portion. Also, the tape holding portion has at least one notch portion concaved on at least one surface of the first surface and the second surface of the tape holding portion along the element thickness direction, and a bulging portion which is provided corresponding to the notch portion, and bulging from the tape holding surface adjacent to the bottom surface of the notch portion in the element thickness direction.

[0032] When the fastener element of the present invention is manufactured, the bulging portion can be provided corresponding to the notch portion simultaneously when the notch portion is provided on the tape holding portion along the element thickness direction. Therefore, in the aforementioned second manufacturing method, the fastener element of the present invention can be easily manufactured by conducting a press processing to the element component cut out of the wire material having a substantially Y-shaped cross section along the element

thickness direction. Accordingly, the fastener element in which the bulging portion is bulged from the tape holding surface can be provided at a low cost.

[0033] In the fastener element of the present invention, it is possible to easily increase a size of the bulging portion (bulging height, in particular) to correspond to a size of the notch portion. Thereby, when the fastener element is attached to a fastener tape, the bulging portion which is formed to be large on the fastener element can dig into the fastener tape (a core string portion of the fastener tape, in particular) deeply, and the fastener tape can dig (enter) into the formed notch portion. As a result, the slip strength of the fastener element with respect to the fastener tape can be easily increased, and the pull-out strength of the fastener element can also be enhanced.

[0034] Further, since the bulging portion is formed to have a large bulging height on the fastener element as mentioned above, in a case that the manufactured fastener element undergoes a polishing step such as barrel polishing before being attached to the fastener tape, the bulging portion can stably have an appropriate size (bulging height) capable of enhancing the slip strength, even after being scraped to a certain degree in the polishing step.

[0035] In the fastener element of the present invention as above, the bottom surface of the notch portion and the top end surface of the bulging portion are formed to be a continuous single surface. Thereby, the bulging portion is stably formed on the tape holding surface of the tape holding portion. In addition, the bulging portion can be formed to be large easily to correspond to the size of the notch portion.

[0036] The notch portion provided on the tape holding portion is formed to be a tapered shape such that a cross-sectional area of a space orthogonal to the element thickness direction is gradually decreased toward the bottom surface of the notch portion. Thereby, when the fastener element is manufactured, the notch portion can be formed in a predetermined shape and size, and the bulging portion corresponding to the notch portion can be stably formed. In addition, in the element molding part press-processing the element component in the manufacturing device of the fastener element, a strength of the protruded pressing part forming the notch portion is easy to be secured, and the protruded pressing part can be effectively prevented from being damaged.

[0037] Further, in the present invention, a plurality of the notch portions and a plurality of the bulging portions are symmetrically formed about the center surface in the element width direction. Thereby, the bulging portions of the fastener element can attach the fastener element digging into top and back surfaces of the fastener tape symmetrically, and the slip strength of the fastener element can be effectively increased. In addition, even when the fastener element attached to the fastener tape receives an external force, a posture of the fastener element can be stably maintained.

[0038] In the present invention, the tape holding portion of the fastener element further has protruded rib portions protruded on the tape holding surface continuously along the element thickness direction. Thereby, the slip strength of the fastener element is further increased, and the pull-out strength of the fastener element with respect to the fastener tape can be enhanced.

[0039] The notch portion of the fastener element is concaved on the first surface of the tape holding portion. Thereby, when the fastener element is manufactured from the element component using the manufacturing device of the fastener element, the notch portion and the bulging portion can be formed smoothly and stably by press-processing the element component from above the first surface on which the coupling concave portion is provided. This case can be dealt with relatively easily by changing a shape of the pressure pad in the element molding part disposed in the conventional manufacturing device. Therefore, a facility cost required for improvement can be suppressed.

[0040] Next, the manufacturing device of a fastener element provided by the present invention has a wire material supply part supplying the element-use wire material along a length direction, the cutting punch cutting the element-use wire material at a predetermined thickness and forming an element component, and the element molding part conducting the press molding to the element component to mold the coupling concave portion and the coupling convex portion. The element molding part has a protruded pressing part locally pressing the tape holding portion of the element component along the element thickness direction to be plastically deformed.

[0041] In this case, the protruded pressing part is formed to be able to conduct the press processing with respect to the tape holding portion along the element thickness direction to a predetermined depth. The protruded pressing part has a shape capable of forming the notch portion which is concaved on the tape holding portion along the element thickness direction and open on a tape holding surface of the tape holding portion as well as forming a bulging portion protruded adjacent to the bottom surface of the notch portion by plastic flow along with formation of the notch portion simultaneously.

[0042] According to the manufacturing device of the present invention which has the protruded pressing part on the element molding part as above, the fastener element of the present invention provided with the notch portion and the bulging portion disposed corresponding to the notch portion in the tape holding portion can be continuously manufactured stably from the element-use wire material having a substantially Y-shaped lateral cross section.

[0043] Also in the manufacturing device of the present invention as above, the element molding part has the forming die on which the element component is placed, the pressure pad disposed to be able to move up and down with respect to the forming die and pressing and holding the tape holding portion of the element component toward the forming die, and the forming punch dis-

posed to be able to move up and down with respect to the forming die and press-molding the element component.

[0044] The pressure pad has a component holding part pressing and holding the tape holding portion of the element component with a tip end surface, and the insertion part hanging from the tip end surface of the component holding part and inserted between the first leg portion and the second leg portion of the tape holding portion. In this case, the protruded pressing part forming the notch portion on the tape holding portion of the element component is protruded at a base end part of the insertion part in the pressure pad from an outer peripheral side surface of the insertion part in an orthogonal direction to the hanging direction of the insertion part.

[0045] Since the element molding part has the forming die, the pressure pad and the forming punch, as mentioned above, the element molding part capable of press-molding the element component can be formed in a relatively simple structure. Further by press-molding the element component at the element molding part, the fastener element in which a coupling concave portion and a coupling convex portion are provided on a coupling head portion, and the notch portion and the bulging portion are provided on the tape holding portion can be stably manufactured.

[0046] Also in this case, the protruded pressing part of the pressure pad has a shape such that a cross-sectional area orthogonal to the hanging direction of the insertion part is decreased with distance from the tip end surface of the component holding part. Thereby, the strength of the protruded pressing part in the pressure pad can be easily secured, and the protruded pressing part can be formed to be less likely to be damaged. Also with the protruded pressing part, the notch portion can be formed in a predetermined shape and size on the tape holding portion of the element component, and the bulging portion corresponding to the notch portion can be stably formed.

[0047] Next, the manufacturing method of a fastener element provided by the present invention includes forming the element component by cutting the element-use wire material at a predetermined thickness, and molding the coupling concave portion and the coupling convex portion by press-molding the element component. Further, the manufacturing method of the present invention includes, when the tape holding portion of the element component is held in press-molding the provisional coupling head portion, press-processing to locally press the tape holding portion of the element component along the element thickness direction to be plastically deformed.

[0048] By conducting the press processing as mentioned above, the notch portion concaved along the element thickness direction and open on the tape holding surface of the tape holding portion can be stably formed on the tape holding portion. At the same time of formation of the notch portion, a bulging portion bulged adjacent to the bottom surface of the notch portion by plastic flow along with formation of the notch portion can be stably formed.

[0049] Therefore, according to the manufacturing method of the present invention including the step as above, the fastener element of the present invention provided with the notch portion and the bulging portion disposed corresponding to the notch portion in the tape holding portion can be continuously, efficiently and stably manufactured from the element-use wire material having a substantially Y-shaped lateral cross section.

Brief Description of the Drawings

[0050]

Fig. 1 is a plan view illustrating a slide fastener having fastener elements of the present invention.

Fig. 2 is a perspective view illustrating the fastener element before being attached to a fastener tape.

Fig. 3 is a bottom view of the fastener element viewing from a second surface (lower surface).

Fig. 4 is a side view of the fastener element viewing from a side.

Fig. 5 is a cross-sectional view along the V-V line in Fig. 3.

Fig. 6 is an enlarged perspective view illustrating a main part of a notch portion and a bulging portion provided on the fastener element.

Fig. 7 is an enlarged perspective view illustrating a main part of a manufacturing device of the fastener element.

Fig. 8 is an enlarged perspective view illustrating a lower end part of a pressure pad disposed on the manufacturing device.

Fig. 9 is a schematic view illustrating a state that an element-use wire material is protruded on a sliding contact surface of a cutting die in the manufacturing device.

Fig. 10 is a schematic view illustrating a state that the element component is cut out of the element-use wire material in the manufacturing device.

Fig. 11 is a schematic view illustrating a state that the element component is press-processed to be molded to the fastener element.

Fig. 12 is a perspective view illustrating the element component.

Fig. 13 is a perspective view illustrating a conventional fastener element.

Modes for Carrying Out the Invention

[0051] Hereinafter, modes for carrying out the present invention will be described in detail with reference to the drawings. It should be noted that the present invention is not limited to the embodiment explained as below, and various changes can be made as long as having a substantially same structure and similar functional effects to the present invention.

[0052] Fig. 1 is a plan view illustrating a slide fastener of the Embodiment. Fig. 2, Fig. 3 and Fig. 4 are a perspective view, a bottom view and a side view of the fastener element, respectively. Fig. 5 is a cross-sectional view along the V-V line shown in Fig. 3. Fig. 6 is a perspective view illustrating an enlarged main part of the fastener element.

[0053] In the following descriptions of the fastener element, an upper and lower direction or a thickness direction of the fastener element means a direction to be a tape length direction when the fastener element is attached to a fastener tape. Particularly, a fist surface on which a coupling concave portion of the fastener element is formed is referred to as a lower surface, and a second surface on which a coupling convex portion is formed is referred to as an upper surface.

[0054] A front and rear direction or a longitudinal direction of the fastener element means a direction to be a tape width direction of the fastener tape when the fastener element is attached to the fastener tape. Particularly, a tip end direction of a coupling head portion is referred to as a front direction, and a direction in which a first leg portion and a second leg portion extend is referred to as a rear direction. Further, a right and left direction or a width direction means a direction to be a tape top and back direction when the fastener element is attached to the fastener tape.

[0055] A slide fastener 1 according to the Embodiment has a pair of first fastener stringer 2a and second fastener stringer 2b on which a plurality of metallic fastener elements 10 are lined on facing tape side edge parts of a pair of fastener tapes 3 to form element rows 7, a first end stop 4 (also referred to as an upper end stop) disposed on one end part of the first and second fastener stringers 2a, 2b to be adjacent to the element row 7, a second end stop 5 (also referred to as a lower end stop) disposed to bridge the other end part of the first and second fastener stringers 2a, 2b to be adjacent to the element row 7, and a slider 6 disposed slidably along the element rows 7 for coupling and separating the element rows 7 of the first and the second fastener stringers 2a, 2b.

[0056] In this case, a core string portion 3a bulging in the tape top and back direction is provided on the tape side edge part of the fastener tape 3. In the following, the element row 7 formed on the first fastener stringer 2a is called as the first element row 7a, and the element row 7 formed on the second fastener stringer 2b is called as the second element row 7b.

[0057] The slide fastener 1 of the Embodiment has a feature in a configuration of the metallic fastener element 10 forming the element row 7, and members other than the metal element 10 are formed similar to conventional general slide fasteners. Therefore, in the following descriptions, a configuration of the metal element 10 will be mainly described, and a detailed description of the members other than the metal element 10 is omitted.

[0058] The metal element 10 of the Embodiment consists of a metal such as copper alloy, nickel alloy, aluminum alloy and the like, and a plurality of the metal elements 10 are attached to the tape side edge part of the fastener tape 3 at constant intervals along the tape length direction.

[0059] Each metal element 10 has a coupling head portion 11 provided with the coupling concave portion 12 and the coupling convex portion 13, and a tape holding portion 16 extending from the coupling head portion 11 toward the rear direction. The tape holding portion 16 has a body portion 17 integrally formed continuously from the coupling head portion 11, and a right and left pair of a first leg portion 18a and a second leg portion 18b which are branched from the body portion 17 and extend toward the rear direction.

[0060] In this case, the tape holding portion 16 of the metal element 10 has a holding space 20 formed to be surrounded by the body portion 17, the first leg portion 18a and the second leg portion 18b. In the tape holding portion 16, a tape holding surface 19 is formed to continue from the first leg portion 18a to the second leg portion 18b via the body portion 17, and to face the holding space 20. The metal element 10 of the Embodiment is formed bilaterally symmetrical about a flat surface as a symmetrical surface passing a center in the element width direction.

[0061] The fastener element 10 schematically shown in Fig. 2 to Fig. 5 has a shape in a state before being attached to the fastener tape 3, i.e. a substantially Y shape so as the first leg portion 18a and the second leg portion 18b of the tape holding portion 16 to be open in the element width direction. This fastener element 10 is attached to the fastener tape 3 by pressing the first leg portion 18a and the second leg portion 18b in a direction approaching each other to be plastically deformed in a state that the tape side edge part of the fastener tape 3 is inserted between the first leg portion 18a and the second leg portion 18b, and the tape side edge part is contacted with the tape holding surface 19 of the body portion 17 and held in the holding space 20.

[0062] The coupling concave portion 12 is concaved on the lower surface (first surface) of the coupling head portion 11, and the coupling convex portion 13 is protruded on the upper surface (second surface) of the coupling head portion 11 in the Embodiment. In this case, the coupling convex portion 13 is formed to bulge upward in a dome shape at a position corresponding to the coupling concave portion 12 on the upper surface of the coupling head portion 11. The coupling concave portion 12 has a bottomed hole shape having an accommodating space capable of accommodating the coupling convex portion 13 of the counterpart metal element 10 to be coupled. In this case, the bottom surface of the coupling concave portion 12 is formed to be a flat surface parallel to the lower surface of the coupling head portion 11.

[0063] In order to suppress sliding resistance at the time of sliding the slider 6 in the slide fastener 1 shown in Fig. 1, the coupling head portion 11 of the Embodiment

has a tip end sloped portion 14 formed on the lower surface side tip end part (front end part) of the coupling head portion 11, and a chamfered portion 15 provided on the upper surface side of the coupling head portion 11.

[0064] The tip end sloped portion 14 has a sloped surface obliquely sloped from the lower surface of the coupling head portion 11 toward the tip end surface. The tip end sloped portion 14 is formed such that a width dimension of the sloped surface is gradually increased toward the tip end of the coupling head portion 11 in the bottom view of the fastener element 10 (Fig. 3). The chamfered portion 15 is provided at an outer peripheral edge part on the upper surface side of the coupling head portion 11 in a shape such that a corner part between the upper surface of the coupling head portion 11 and the tip end surface and the side surface of the coupling head portion 11 is scraped off.

[0065] Since the tip end sloped portion 14 and the chamfered portion 15 as above are provided on the coupling head portion 11 of the metal element 10, when the first element row 7a and the second element row 7b are coupled or separated by sliding the slider 6 of the slide fastener 1, the fastener element 10 of the first element row 7a and the fastener element 10 of the second element row 7b are less likely to bump or get caught with each other in an element guide path of the slider 6. As a result, sliding resistance of the slider 6 can be prevented from being increased, and sliding operation of the slider 6 can be performed lightly.

[0066] The tape holding portion 16 of the metal element 10 has four notch portions 21 notching the lower surface (first surface) of the tape holding portion 16, four bulging portions 22 formed corresponding to the four notch portions 21 respectively, and two protruded rib portions 23 continuously protruded on the tape holding surface 19 along the element thickness direction.

[0067] The notch portion 21 is, as shown in an enlarged state in Fig. 6, formed by notching the lower surface of the tape holding portion 16 along the element thickness direction. Also, the notch portion 21 is open to the lower surface of the tape holding portion 16 and the tape holding surface 19. In this case, the notch portion 21 has a flat bottom surface 21a disposed parallel to the lower surface of the tape holding portion 16, a pair of side wall surfaces 21b rising from the bottom surface 21a and formed in a flat surface shape so as to face each other, and a back end surface (inner side end surface) 21c rising from the bottom surface 21a and formed in a flat surface shape furthest away from the tape holding surface 19.

[0068] An inner space of the notch portion 21 is formed to have a rectangular cross section orthogonal to the element thickness direction. In this case, in the notch portion 21, the pair of side wall surfaces 21b are sloped with respect to the element thickness direction so that an interval between the pair of side wall surfaces 21b are gradually increased from the lower surface of the tape holding portion 16 toward the bottom surface 21a of the notch portion 21.

[0069] The back end surface 21c of the notch portion 21 is formed along the element thickness direction, and the back end surface 21c of the notch portion 21 and the tape holding surface 19 of the tape holding portion 16 are disposed substantially parallel. It should be noted that in the present invention, it is also possible that the back end surface 21c of the notch portion 21 is formed to be sloped with respect to the element thickness direction so that a cross-sectional area of the inner space of the notch portion 21 orthogonal to the element thickness direction is decreased toward the bottom surface 21a of the notch portion 21.

[0070] The bulging portion 22 of the tape holding portion 16 is formed to protrude from the tape holding surface 19 toward the tape holding space 20 at a position adjacent to the bottom surface 21a of the notch portion 21 in the element thickness direction. The bulging portion 22 is formed at the same time of forming the notch portion with the protruded pressing part 43c of the pressure pad 43 when the element component 30 (see Fig. 12) is pressed with the pressure pad 43 as described later. That is, the bulging portion 22 is formed by plastic flow along with formation of the notch portion 21. Accordingly, one bulging portion 22 corresponds to one notch portion 21.

[0071] The bulging portion 22 has a flat top end surface 22a formed at a position closest to the lower surface of the tape holding portion 16. The top end surface 22a of the bulging portion 22 is formed to continue from the bottom surface 21a of the notch portion 21 and disposed parallel to the lower surface of the tape holding portion 16. Further, the top end surface 22a of the bulging portion 22 forms a single flat surface with the bottom surface 21a of the notch portion 21. It is also possible that the bottom surface 21a of the notch portion 21 and the top end surface 22a of the bulging portion 22 are formed to slope downward from the back end surface 21c toward a top end of the bulging portion 22 with respect to the lower surface of the tape holding portion 16. The bulging portion 22 has a shape such that the cross-sectional area orthogonal to the element thickness direction becomes small with distance from the top end surface 22a of the bulging portion 22.

[0072] A bulging height (protruded amount) from the tape holding surface 19 in the bulging portion 22 is the largest at the top end surface 22a of the bulging portion 22 and a near part (top end part) thereof. In this case, the bulging height at the top end part of the bulging portion 22 from the tape holding surface 19 is set to be larger than the bulging height of the protruded rib portion 23. A lateral dimension of the bulging portion 22 along the tape holding surface 19 is also set to be larger than a lateral dimension of the protruded rib portion 23 along the tape holding surface 19.

[0073] In the metal element 10 of the Embodiment, the notch portion 21 and the bulging portion 22 corresponding to the notch portion 21 are arranged along the element thickness direction. In a bottom view viewing the metal element 10 from below, the four sets of notch portions

21 and the bulging portions 22 are provided at positions apart from each other at equal intervals on the tape holding portion 16 of the metal element 10.

[0074] The protruded rib portion 23 of the tape holding portion 16 is formed on the entire element thickness direction from a position of the upper surface of the tape holding portion 16 to a position of the lower surface of the tape holding portion 16 along the element thickness direction. A cross section of the protruded rib portion 23 orthogonal to the element thickness direction has the same shape over the entire element thickness direction. In a case of the Embodiment, the cross section of the protruded rib portion 23 orthogonal to the element thickness direction has a substantially triangle shape. The protruded rib portion 23 as above is provided on the tape holding portion 16, thereby a pull-out strength or a slip strength of the fastener element 10 with respect to the fastener tape 3 can be effectively enhanced.

[0075] The fastener element 10 of the Embodiment as mentioned above is manufactured using a manufacturing device 40 as described as below.

[0076] The manufacturing device 40 used in the Embodiment is the manufacturing device 40 manufacturing the fastener element 10 in which the coupling concave portion 12 and the coupling convex portion 13 are formed on the coupling head portion 11 by cutting a metallic element-use wire material (Y-bar) 50 having a substantially Y-shaped lateral cross section at a predetermined thickness to form an element component 30 (Fig. 12), and press-molding the formed element component 30 at the element molding part 41.

[0077] Particularly, the manufacturing device 40 of the Embodiment has a feature in the element molding part 41 to press-mold the element component 30. The element molding part 41 is configured to mold the coupling concave portion 12 and the coupling convex portion 13, and at the same time, to form the notch portion 21 and the bulging portion 22 at the tape holding portion 16. Therefore, although the structure of the manufacturing device 40 is described below, the manufacturing device 40 is described focusing on the element molding part 41 because parts of the manufacturing device 40 other than the element molding part 41 are substantially the same as conventional devices.

[0078] The manufacturing device 40 of the Embodiment has a wire material supply part (not shown) at which the element-use wire material 50 is supplied intermittently at predetermined pitches, a wire cutting part cutting the wire material 50 with a cutting die 46 and a cutting punch 47 at a predetermined thickness to form the element component 30, and the element molding part 41 press-molding the cut element component 30.

[0079] Further, in the manufacturing device 40 of the Embodiment, an element attaching part 48 (crimping punch 48a) attaching the fastener element 10 manufactured by press molding at the element molding part 41 to the fastener tape 3 sequentially by plastically deforming by pressing and a chamfering part 49 (chamfering punch 49a) chamfering the fastener element 10 attached to the fastener tape 3 are further provided.

[0080] In this case, the wire material supply part, the cutting die 46 and the cutting punch 47 of the Embodiment are formed substantially the same as the wire material supply part (also referred to as a wire material feed roller or supply unit part), the cutting die and the cutting punch described in the above-mentioned Patent Document 2 and the Patent Document 3. Also an actuating mechanism of each part in the manufacturing device 40 of the Embodiment is formed substantially the same as the actuating mechanism described in the above-mentioned Patent Document 2 and the Patent Document 3.

[0081] The cutting die 46 and the cutting punch 47 are briefly explained here. In the manufacturing device 40 of the Embodiment, the cutting die 46 and a forming die 42 to be described later, of the element molding part 41 are provided to be able to reciprocate linearly in the front and rear direction by a driving mechanism (not shown) so as to move forward and rearward alternately with respect to the cutting punch 47.

[0082] In this case, an upper surface of the cutting die 46 is formed as a sliding contact surface to which the cutting punch 47 sliding-contacts. On a center part of the cutting die 46 in the width direction, a wire material guide hole 46a open on the sliding contact surface (upper surface) of the cutting die 46 and penetrating the cutting die 46 in the upper and lower direction are provided. The wire material guide hole 46a of the cutting die 46 is formed in a shape corresponding to a lateral cross section of the element-use wire material 50 in the upper and lower direction, and the element-use wire material 50 supplied from the wire material supply part is inserted to the wire material guide hole 26a from below.

[0083] On the upper surface of the cutting die 46, the cutting punch 47 is fixed unmovably on a stand on the manufacturing device 40. Therefore, the cutting die 46 and the forming die 42 reciprocate in the front and rear direction by the driving mechanism (not shown) as above, thereby the fixed cutting punch 47 can relatively move forward and rearward alternately with respect to the cutting die 46 and the forming die 42 while sliding-contacting the upper surface of the cutting die 46.

[0084] Due to having the cutting die 46 and the cutting punch 47 as mentioned above, a part (protruded part) of the element-use wire material 50 which is protruded from the upper surface of the cutting die 46 can be cut with the cutting punch 47 which moves forward relatively, as described later. Thereby, the element component 30 shown in Fig. 12 is formed. Further, by relatively moving the formed element component 30 forward with the cutting punch 47, the element component 30 can be fed smoothly to the forming die 42 of the element molding part 41 positioned in front of the cutting die 46.

[0085] The element molding part 41 of the Embodiment has a forming die 42 placing and supporting from below the element component 30 fed by the cutting punch 47, a pressure pad 43 pressing and holding the element com-

ponent 30 toward the forming die 42, and a forming punch 44 press-molding the element component 30 held between the forming die 42 and the pressure pad 43.

[0086] The forming die 42 has a placing part 42a on which the element component 30 is placed. The placing part 42a is disposed at a position below the upper surface of the forming die 42. The forming die 42 has a predetermined shape capable of molding the coupling head portion 11 of the fastener element 10 by press-processing a provisional coupling head portion 31, to be described later, of the element component 30 in cooperation with the forming punch 44.

[0087] The forming punch 44 is fixed at a punch holding part (not shown) above the forming die 42 on which the element component 30 is placed. The forming punch 44 is provided to be able to reciprocate in the upper and lower direction by a driving mechanism (not shown) so as to move up and down alternately with the punch holding part with respect to the forming die 42.

[0088] At a lower end part of the forming punch 44, a flat contact surface contacting a first surface of the element component 30 (fastener element 10) and a concave-portion-forming pressing part 44a hanging from the contact surface are provided. The concave-portion-forming pressing part 44a has a shape corresponding to the coupling concave portion 12 of the fastener element 10.

[0089] The pressure pad 43 is disposed above the forming die 42 on which the element component 30 is placed, and held at the punch holding part movably up and down. Further, the pressure pad 43 is urged downward by a spring member (not shown).

[0090] The pressure pad 43 has, at a lower end part, a component holding part 43a pressing and holding the tape holding portion 16 of the element component 30 placed on the forming die 42 with a tip end surface, an insertion part 43b hanging from the tip end surface of the component holding part 43a to be inserted between the first leg portion 18a and the second leg portion 18b of the tape holding portion 16, and four protruded pressing parts 43c protruded at a base end part of the insertion part 43b as shown in Fig. 8.

[0091] In this case, the protruded pressing part 43c is protruded from an outer peripheral side surface at the base end part of the insertion part 43b in a direction orthogonal to the hanging direction of the insertion part 43b. Also, the protruded pressing part 43c has a shape such that side wall surfaces thereof obliquely slope with respect to the hanging direction of the insertion part 43b so that a cross-sectional area orthogonal to the hanging direction of the insertion part 43b is decreased with distance from the tip end surface of the component holding part 43a. In the Embodiment, it is also possible to change a size and a shape of the notch portion 21 and the bulging portion 22 provided on the fastener element 10 by changing a size and a shape of the protruded pressing part 43c provided on the pressure pad 43.

[0092] When such a pressure pad 43 contacts the element component 30 placed on the forming die 42, the insertion part 43b of the pressure pad 43 is inserted first between the first leg portion 18a and the second leg portion 18b of the element component 30. In this case, as the position of the insertion part 43b of the pressure pad 43 with respect to the first leg portion 18a and the second leg portion 18b of the element component 30 is shown with an imaginary line in Fig. 3, a small gap is provided between the insertion part 43b of the pressure pad 43 and the first leg portion 18a and the second leg portion 18b of the element component 30.

[0093] After the insertion part 43b of the pressure pad 43 is inserted as above, the pressure pad 43 is further lowered, thereby the component holding part 43a of the pressure pad 43 holds the element component 30 placed on the forming die 42 from above, and each protruded pressing part 43c of the pressure pad 43 can press-process as described later to the tape holding portion 16 of the element component 30.

[0094] The element attaching part 48 and the chamfering part 49 of the manufacturing device 40 in the Embodiment is formed substantially the same as the element attaching part (also referred to as the crimping part) and the chamfering part described in Patent Document 3.

[0095] Briefly described, the element attaching part 48 of the Embodiment has a right and left pair of crimping punches 48a pressing the first leg portion 18a and the second leg portion 18b of the fastener element 10 toward the fastener tape 3 to be plastically deformed. The chamfering part 49 has a right and left pair of chamfering punches 49a disposed above the right and left crimping punches 48a. The chamfering part 49 can chamfer a ridge line part of the tape holding portion 16 by pressing the tape holding portion 16 of the fastener element 10 attached to the fastener tape 3 with the chamfering punches 49a from right and left sides.

[0096] Next, a method for manufacturing the fastener element 10 as shown in Fig. 2 to Fig. 5 from the Y-shaped element-use wire material 50 serially using the above manufacturing device 40, and further attaching the manufactured fastener element 10 to the fastener tape 3 is described.

[0097] As a preparation step for manufacturing the fastener element 10, first, the element-use wire material (Y-bar) 50 is prepared. The element-use wire material 50 used in the Embodiment is formed by passing a long metal wire material having a circular cross section through a plurality of rolls and molding to show, for example, the same lateral cross section as the element component 30 shown in Fig. 12.

[0098] In the manufacturing method in the Embodiment, first, the element-use wire material 50 is intermittently supplied at predetermined pitches from a wire material supply part (not shown) disposed below the cutting die 46 to the cutting die 46. Thereby, the element-use wire material 50 passes the wire material guide hole 46a of the cutting die 46 as shown in Fig. 9, and can further protrude upward from an upper surface (sliding contact surface) of the cutting die 46 by a thickness dimension

of the fastener element 10. At this time, the cutting die 46 is stopped at the most advanced position with respect to the cutting punch 47.

[0099] In the manufacturing device 40 of the Embodiment, while the fastener elements 10 are manufactured one after another from the element-use wire material 50, the manufactured fastener elements 10 are plastically deformed and attached to the fastener tape 3 in sequence. Therefore, in a state that the element-use wire material 50 is protruded from the upper surface (sliding contact surface) of the cutting die 46 by a predetermined thickness as shown in Fig. 9, the fastener element 10 which is manufactured one element ahead is already attached to the fastener tape 3 by the crimping punch 48a.

[0100] After the wire material 50 is protruded on the sliding contact surface of the cutting die 46, the cutting die 46 is moved rearward together with the wire material 50 by the driving mechanism. Thereby, the cutting punch 47 relatively moves forward with respect to the cutting die 46. Therefore, the element-use wire material 50 is cut by the cutting punch 47 and the cutting die 46 which are cutting means at a predetermined thickness (protruded amount) protruded on the sliding contact surface. As a result, the element component 30 having a constant thickness can be formed as shown in Fig. 12.

[0101] In this case, the element component 30 has a provisional coupling head portion 31 having a flat first surface (lower surface) and a flat second surface (upper surface), and a tape holding portion 16 extending from the provisional coupling head portion 31. In the tape holding surface 19 of the tape holding portion 16 in the element component 30, the notch portion 21 and the bulging portion 22 are not formed. However, the protruded rib portions 23 along the element thickness direction have been already formed. The protruded rib portion 23 of the element component 30 is formed at the element-use wire material 50 when the substantially Y-shaped element-use wire material 50 is produced by rolling from the wire material 50 in the above-mentioned preparation step.

[0102] As the cutting die 46 further moves rearward, the element component 30 cut out of the element-use wire material 50 relatively moves forward while being held with the cutting punch 47 as shown in Fig. 10, and is guided to a position of the forming die 42 disposed in front of the cutting die 46.

[0103] Then, when the cutting die 46 moves to a rear end position of the reciprocation, the element component 30 having moved to a front end part of the forming die 42 moves away from the cutting punch 47 and drops on the placing part 42a of the forming die 42. Thereby, the element component 30 is placed on the placing part 42a of the forming die 42 in a predetermined direction. At this time, the upper surface of the placing part 42a of the forming die 42 is formed in a planar shape corresponding to the coupling convex portion 13 and the chamfering part 15 formed on the coupling head portion 11 of the fastener element 10.

[0104] Subsequently, the forming punch 44 and the pressure pad 43 standing by above the forming die 42 are descended together toward the element component 30 placed on the forming die 42 as shown in Fig. 11. Thereby, first, the insertion part 43b of the pressure pad 43 shown in Fig. 8 is inserted between the first leg portion 18a and the second leg portion 18b of the element component 30, and further, press molding is carried out to press the tape holding portion 16 of the element component 30 from above by the four protruded pressing parts 43c of the pressure pad 43.

[0105] At this time, the insertion part 43b of the pressure pad 43 is inserted at a position separate from the tape holding surface 19 of the tape holding portion 16 with respect to the element component 30 as above, and a small gap is formed between the insertion part 43b of the pressure pad 43 and the tape holding surface 19 of the tape holding portion 16.

[0106] Subsequently, the four protruded pressing parts 43c provided on the pressure pad 43 contact the first surface of the tape holding portion 16 of the element component 30, and further descend to a predetermined depth along the element thickness direction. Thereby, the tape holding portion 16 of the element component 30 is locally pressed, and the four notch portions 21 are formed on the tape holding portion 16 straight from the first surface along the element thickness direction with a predetermined dimension.

[0107] Also, when the notch portions 21 are formed on the tape holding portion 16 of the element component 30 with the protruded pressing parts 43c of the pressure pad 43, a part adjacent to the bottom surface 21a of the notch portion 21 in the element thickness direction is bulged from the tape holding surface 19 toward the tape holding space 20 simultaneously by plastic flow of a metal part in a forming region of the notch portion 21. Thereby, the four bulging portions 22 corresponding to respective notch portions 21 are formed.

[0108] Therefore, in the Embodiment, the cut out tape holding portion 16 of the element component 30 is press-processed with the protruded pressing parts 43c of the pressure pad 43 from above the element component 30 along the element thickness direction, thereby the four notch portions 21 and the four bulging portions 22 can be easily and stably formed on the tape holding portion 16.

[0109] Then, the pressure pad 43 keeps descending to a predetermined depth, and the component holding part 43a (tip end surface) of the pressure pad 43 contacts the first surface of the tape holding portion 16 of the element component 30. Thereby, the tape holding portion 16 of the element component 30 on which the notch portions 21 and the bulging portion 22 are formed can be held and fixed between the pressure pad 43 and the forming die 42.

[0110] Also as above, the element component 30 is held with the pressure pad 43 and at the same time, the forming punch 44 is descended to press-mold the element component 30 from above. Such a press molding

is also called as a ridge formation. The provisional coupling head portion 31 of the element component 30 is press-molded by the forming punch 44, thereby the coupling concave portion 12, the coupling convex portion 13, the tip end sloped portion 14 and the chamfering portion 15 of the fastener element 10 as above can be stably formed.

[0111] The cutting processing of the wire material 50 with the cutting die 46 and the cutting punch 47 as well as the press molding of the pressure pad 43 and the forming punch 44 as above are carried out to coincide with the timing of supplying the wire material 50 supplied from the wire material supply part intermittently. Thus, a plurality of fastener elements 10 of the Embodiment can be continuously manufactured from the long Y-shaped wire material 50.

[0112] As above, the fastener elements 10 are manufactured from the Y-shaped wire material 50, thereby production efficiency can be enhanced while production cost can be reduced, compared with a case of punching a flat plate-shaped metallic plate member to manufacture the fastener elements 10 having the same shape.

[0113] Further, in the manufacturing device 40 of the Embodiment, the fastener elements 10 of the Embodiment are manufactured as above, and the manufactured fastener elements 10 can be attached to the fastener tape 3 in sequence. In this case, the fastener tape 3 is drawn up by a tape feeding part (not shown) intermittently at a predetermined timing and with a predetermined length at a position with a constant distance from the cutting punch 47 which is fixed unmovably.

[0114] As mentioned above, the press molding with the pressure pad 43 and the forming punch 44 is carried out when the cutting die 46 is stopped at the rear end position (or a nearby position) of the reciprocation. Therefore, as the cutting die 46 moves forward together with the forming die 42, the fastener element 10 manufactured by press molding first approaches the fastener tape 3 in a state of being placed on the forming die 42. At this time, along with the forward movement of the cutting die 46, a pair of the crimping punches 48a of the element attaching part 48 start moving and hold the first leg portion 18a and the second leg portion 18b of the fastener element 10 from an outside.

[0115] Further, as the cutting die 46 moves to a front end position of the reciprocation, the fastener tape 3 is inserted between the first leg portion 18a and the second leg portion 18b of the fastener element 10. Thereafter, the first leg portion 18a and the second leg portion 18b of the fastener element 10 are pressed from an outside with the pair of crimping punches 48a so as to approach each other to be plastically deformed (crimped). Thereby, the fastener element 10 is attached (implanted) to a predetermined position of the fastener tape 3 at a front end position of the cutting die 46.

[0116] As mentioned above, while the cutting die 46 moves to the front end position, and the fastener element 10 is attached to the fastener tape 3, the element-use wire material 50 is supplied from the wire material supply part (not shown). Thereby, the element-use wire material 50 is protruded on the sliding contact surface of the cutting die 46 only by the thickness of the fastener element 10 (i.e. returned to the state of Fig. 9).

[0117] Then, a sequence of operations as mentioned above is repeated continuously, thereby a plurality of the fastener elements 10 are attached to the tape side edge parts of the fastener tape 3 along the tape length direction at predetermined attaching pitches. Thus, the fastener stringer for the slide fastener 1 is manufactured.

[0118] Also in the manufacturing device 40 in the Embodiment as shown in Fig. 7, the pair of chamfering punches 49a of the chamfering part 49 are disposed above the crimping punch 48a of the element attaching part 48. Due to working of such a pair of chamfering punches 49a, it is possible to chamfer the preceding fastener element 10 which is already implanted in the fastener tape 3.

[0119] The manufacturing device 40 of the Embodiment as mentioned above has a structure that the element component 30 is press-molded using the pressure pad 43 and the forming punch 44 to manufacture the fastener element 10, and subsequently, the manufactured fastener element 10 is attached to the fastener tape 3. In the present invention, however, it is possible that after the fastener element 10 is manufactured by press-molding, the manufactured fastener element 10 is collected without being attached to the fastener tape 3. Further, it is also possible that the collected plural fastener elements 10 undergo a polishing processing such as barrel polishing.

[0120] In the fastener element 10 of the Embodiment thus manufactured, a plurality of notch portions 21 notched in the element thickness direction are formed on the tape holding portion 16. Further, the metal material of the fastener element 10 is fluidly and plastically deformed along with formation of the notch portion 21, thereby the bulging portions 22 bulging from the tape holding surface 19 toward the tape holding space 20 in a large bulging amount are formed. Particularly, the bulging portion 22 of the Embodiment has a shape bulging in a larger degree than the protruded rib portion 23 from the tape holding surface 19 of the tape holding portion 16 in a direction orthogonal to the element thickness direction.

[0121] Therefore, as the fastener element 10 of the Embodiment is attached to the fastener tape 3, the bulging portion 22 provided on the tape holding portion 16 is locally and strongly pressed (dug in deeply) to the tape side edge part (string core portion 3a, in particular) of the fastener tape 3. At the same time, the fastener tape 3 can be dug (entered) into the notch portion 21 provided on the tape holding portion 16. Thereby, a slip strength and a pull-out strength of the fastener element 10 with respect to the fastener tape 3 can be effectively increased.

[0122] Also, the bulging portion 22 of the fastener el-

ement 10 of the Embodiment is formed to bulge in a larger degree than the protruded rib portion 23 from the tape holding surface 19. Therefore, also in a case that the fastener element 10 of the Embodiment undergoes the polishing step before being attached to the fastener tape 3, the bulging portion 22 can be stably remained in a shape to bulge from the tape holding surface 19 on the tape holding portion 16 of the fastener element 10 after the polishing step.

[0123] It should be noted that in the present invention, a size, an arrangement position, the number arranged and the like of the notch portion 21 and the bulging portion 22 provided on the tape holding portion 16 of the fastener element 10 can be arbitrarily changed by changing a shape, a position, the number and the like of the protruded pressing part 43c provided on the pressure pad 43 of the manufacturing device 40.

[0124] Further, in the fastener element 10 of the above Embodiment, the notch portion 21 formed from the first surface (lower surface) of the tape holding portion 16 and the bulging portion 22 corresponding to the notch portion 21 are formed. In the present invention, however, it is also possible to provide an insertion part and a protruded pressing part similar to the insertion part 43b and the protruded pressing part 43c provided on the pressure pad 43 of the above Embodiment on the placing part 42a of the forming die 42 in the manufacturing device 40. Thereby, it is possible to manufacture the fastener element on which the notch portion notching the second surface (upper surface) opposite to the first surface and the bulging portion corresponding thereto are formed in addition to (or instead of) forming the notch portion 21 notching the first surface (lower surface) and the bulging portion 22 corresponding thereto on the tape holding portion 16.

Reference signs

[0125]

1: slide fastener
2a: first fastener stringer
2b: second fastener stringer
3: fastener tape
3a: core string portion
4: first end stop
5: second end stop
6: slider
7: element row
7a: first element row
7b: second element row
10: metallic fastener element (metal element)
11: coupling head portion
12: coupling concave portion
13: coupling convex portion
14: tip end sloped portion
15: chamfered portion
16: tape holding portion
17: body portion
18a: first leg portion
18b: second leg portion
19: tape holding surface
20: holding space
21: notch portion
21a: bottom surface
21b: side wall surface
21c: back end surface (inner side end surface)
22: bulging portion
22a: top end surface
23: protruded rib portion
30: element component
31: provisional coupling head portion
40: manufacturing device
41: element molding part
42: forming die
42a: placing part
43: pressure pad
43a: component holding part
43b: insertion part
43c: protruded pressing part
44: forming punch
44a: concave-part-forming pressing part
46: cutting die
46a: wire material guide hole
47: cutting punch
48: element attaching part
48a: crimping punch
49: chamfering part
49a: chamfering punch
50: wire material (Y-bar)

Claims

1. A metallic fastener element (10) for a slide fastener (1), the fastener element (10) comprising a coupling head portion (11) and a tape holding portion (16) extending from the coupling head portion (11), wherein a coupling concave portion (12) is concaved on a first surface of the coupling head portion (11) and a coupling convex portion (13) is protruded on a second surface of the coupling head portion (11), the tape holding portion (16) has a body portion (17) extending from the coupling head portion (11) and a pair of first leg portion (18a) and second leg portion (18b) branched and further extending from the body portion (17), and a tape holding surface (19) is continuously formed from the first leg portion (18a) to the second leg portion (18b) via the body portion (17), being **characterized in that**:
the tape holding portion (16) has at least one notch portion (21) concaved on at least one surface of the first surface and the second surface of the tape holding portion (16) along an element thickness direction and opened on the tape holding surface (19), and a bulging portion (22) adjacent to a bottom surface

(21a) of the notch portion (21) in the element thickness direction and bulging from the tape holding surface (19).

2. The fastener element according to claim 1, being **characterized in that** the bottom surface (21a) of the notch portion (21) and a top end surface (22a) of the bulging portion (22) are formed to be a continuous single surface.

3. The fastener element according to claim 1 or 2, being **characterized in that** the notch portion (21) is formed in a tapered shape in which a cross-sectional area of a space orthogonal to the element thickness direction is gradually decreased toward the bottom surface (21a) of the notch portion (21).

4. The fastener element according to any one of claims 1 to 3, being **characterized in that** a plurality of the notch portions (21) and a plurality of the bulging portions (22) are formed symmetrically about a center surface in an element width direction.

5. The fastener element according to any one of claims 1 to 4, being **characterized in that** the tape holding portion (16) has a protruded rib portion (23) protruded continuously on the tape holding surface (19) along the element thickness direction.

6. The fastener element according to any one of claims 1 to 5, being **characterized in that** the notch portion (21) is concaved on the first surface of the tape holding portion (16) .

7. A manufacturing device (40) of a fastener element comprising a wire material supply part supplying an element-use wire material (50) having a substantially Y-shaped lateral cross section intermittently at predetermined pitches, a cutting punch (47) cutting the element-use wire material (50) at a predetermined thickness and forming an element component (30) having a provisional coupling head portion (31) and a tape holding portion (16) extending from the provisional coupling head portion (31), and an element molding part (41) press-molding the provisional coupling head portion (31) of the element component (30) to mold a coupling concave portion (12) on a first surface of the provisional coupling head portion (31) and a coupling convex portion (13) on a second surface of the provisional coupling head portion (31), being **characterized in that**:
the element molding part (41) has a protruded pressing part (43c) forming a notch portion (21) concaved on the tape holding portion (16) of the element component (30) by locally pressing the tape holding portion (16) from a first surface along an element thickness direction to be plastically deformed, and a bulging portion (22) bulging adjacent to a bottom surface (21a) of the notch portion (21) by plastic flow along with formation of the notch portion (21).

8. The manufacturing device according to claim 7, being **characterized in that**:
the element molding part (41) has a forming die (42) on which the element component (30) is placed, a pressure pad (43) disposed to be able to move up and down with respect to the forming die (42) and pressing and holding the tape holding portion (16) of the element component (30) toward the forming die (42), and a forming punch (44) disposed to be able to move up and down with respect to the forming die (42) and press-molding the provisional coupling head portion (31) of the element component (30) held between the forming die (42) and the pressure pad (43), wherein:

the pressure pad (43) comprises a component holding part (43a) pressing and holding the tape holding portion (16) of the element component (30) with a tip end surface, and an insertion part (43b) hanging from the tip end surface of the component holding part (43a) and inserted between a first leg portion (18a) and a second leg portion (18b) of the tape holding portion (16), and
the protruded pressing part (43c) is protruded at a base end part of the insertion part (43b) of the pressure pad (43) from an outer peripheral side surface of the insertion part (43b).

9. The manufacturing device according to claim 8, being **characterized in that** the protruded pressing part (43c) of the pressure pad (43) has a shape that a cross-sectional area orthogonal to a hanging direction of the insertion part (43b) is decreased with distance from the tip end surface of the component holding part (43a).

10. A manufacturing method of a fastener element including:
forming an element component (30) having a provisional coupling head portion (31) and a tape holding portion (16) extending from the provisional coupling head portion (31) by cutting an element-use wire material (50) having a substantially Y-shaped lateral cross section with a predetermined thickness, and molding a coupling concave portion (12) on a first surface of the provisional coupling head portion (31) of the element component (30) as well as molding a coupling convex portion (13) on a second surface of the provisional coupling head portion (31) by press-molding the provisional coupling head portion (31), being **characterized in that**:
the method including: forming a notch portion (21) concaved on the tape holding portion (16) by locally pressing the tape holding portion (16) of the element

component (30) from a first surface along an element thickness direction to be plastically deformed when holding the tape holding portion (16) of the element component (30) in the press molding of the provisional coupling head portion (31), and forming a bulging portion (22) bulging adjacent to a bottom surface (21a) of the notch portion (21) simultaneously by plastic flow along with formation of the notch portion (21).

FIG.1

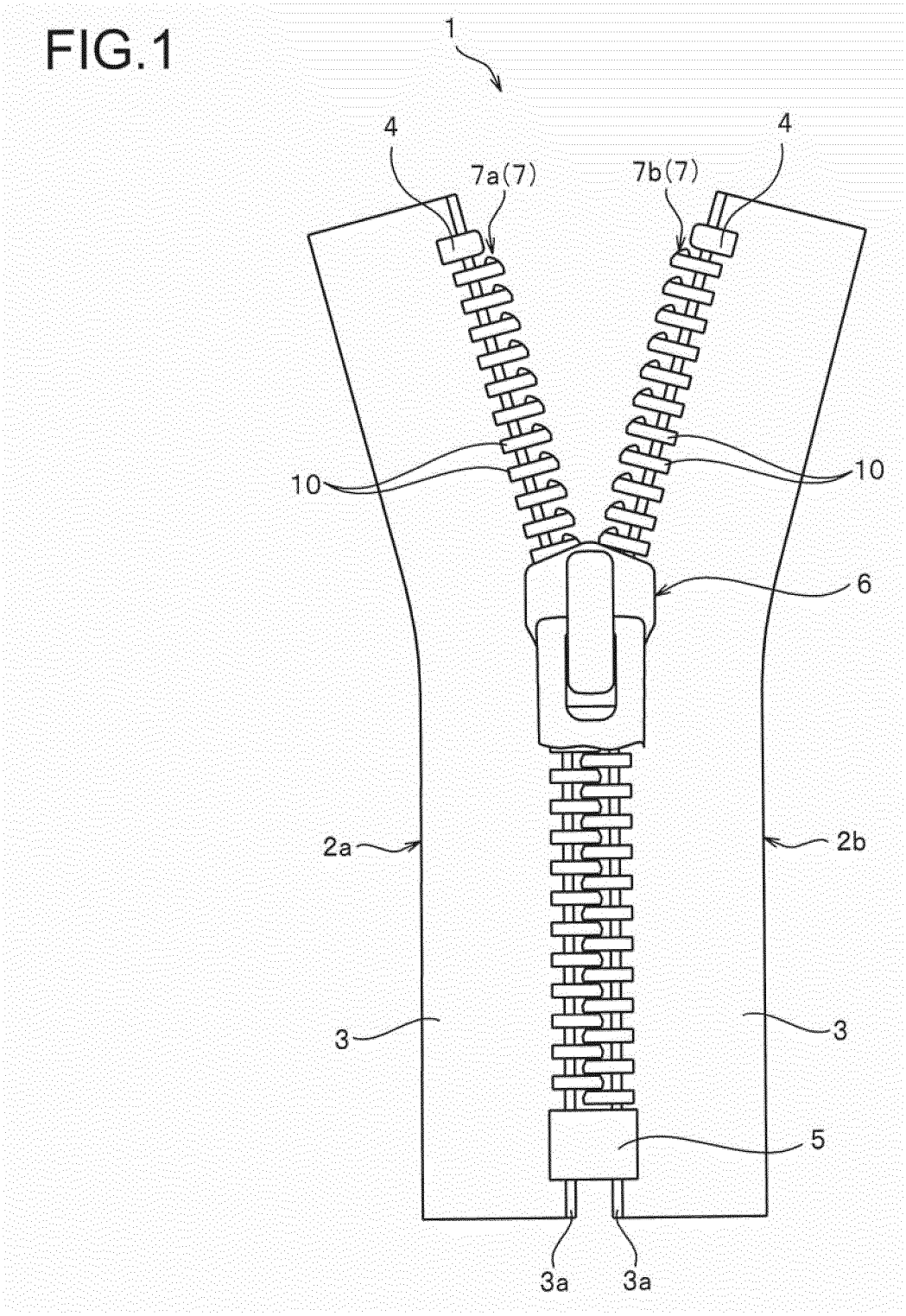


FIG.2

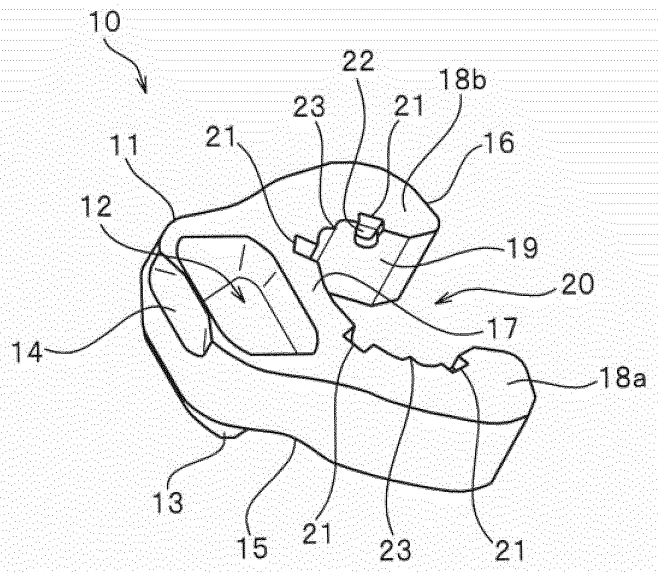


FIG.3

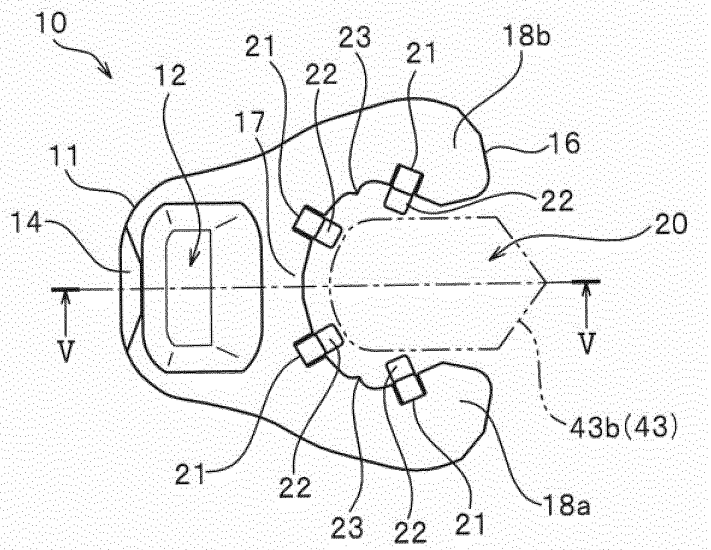


FIG.4

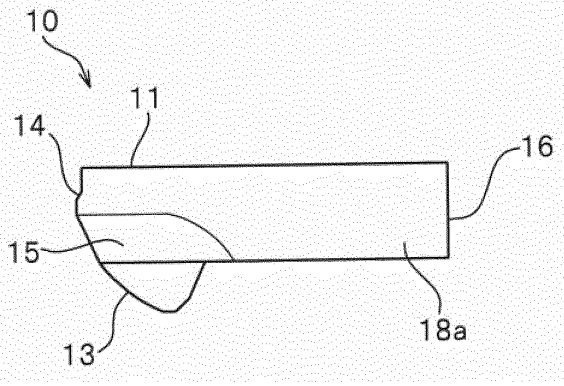


FIG.5

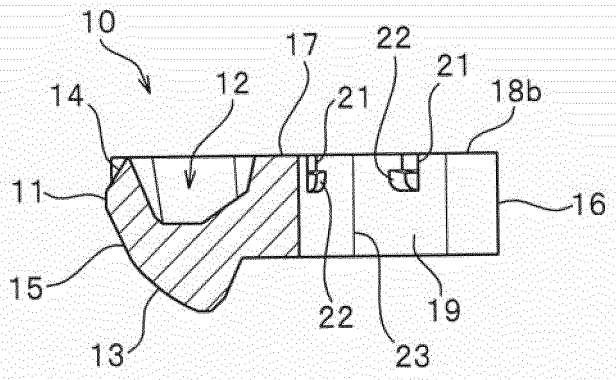

10
17
22
21
18b
14
12
21
11
16
15
22
19
13
23

FIG.6

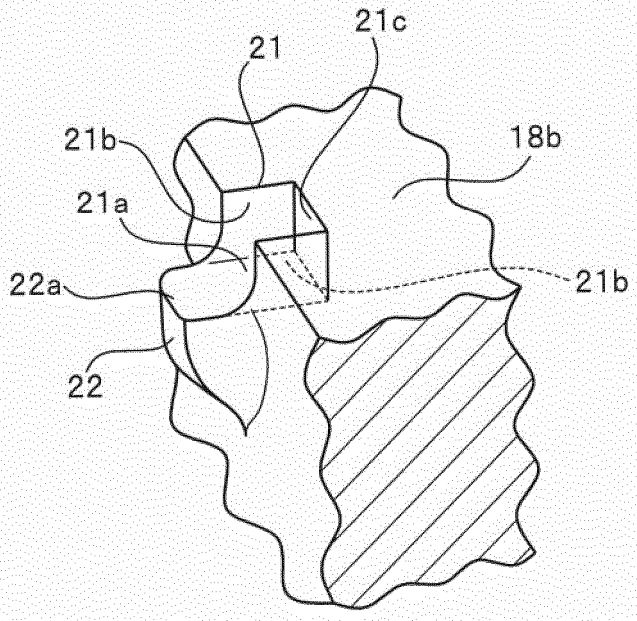

21c
21
21b
18b
21a
22a
21b
22

FIG.7

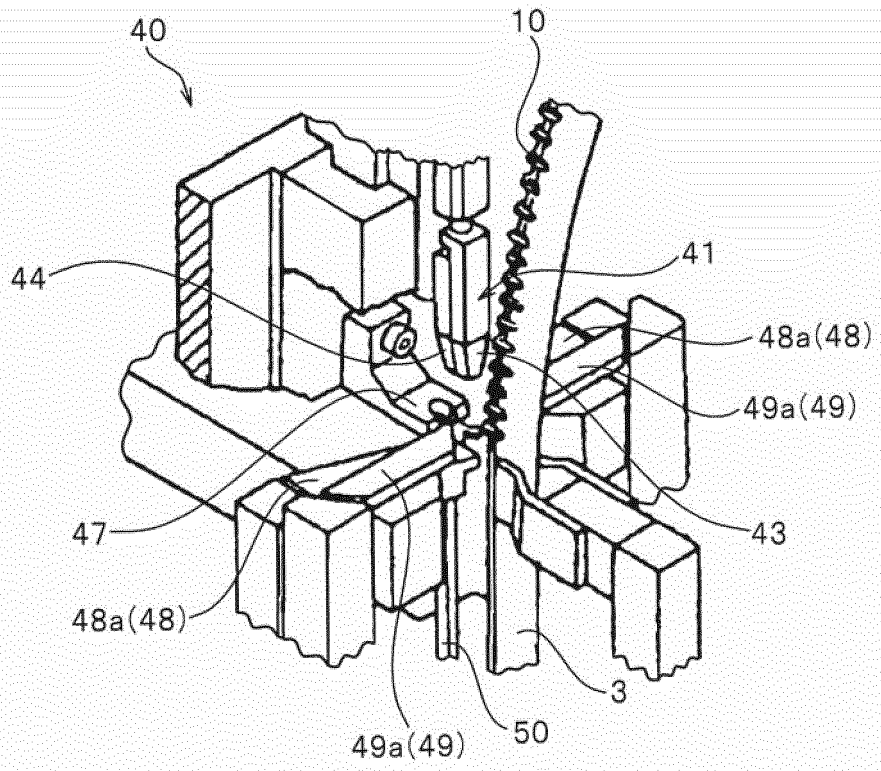

40
10
41
44
48a(48)
49a(49)
43
47
48a(48)
3
49a(49)
50

FIG.8

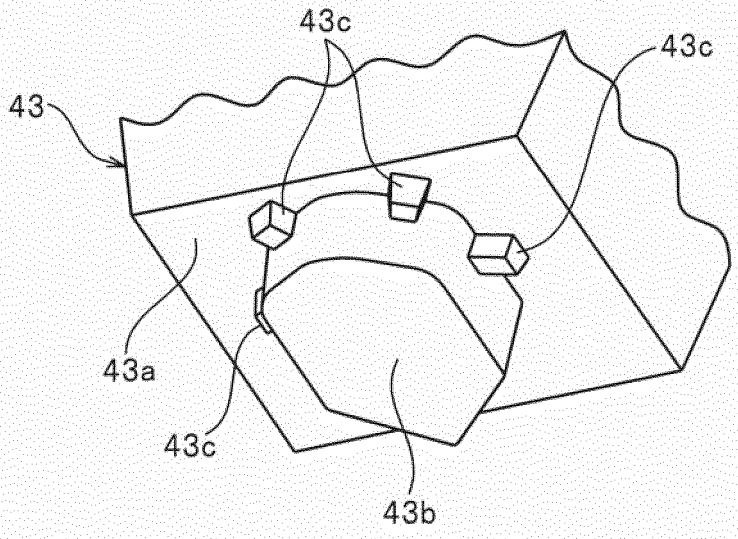

43c
43c
43
43a
43c
43b

FIG.9

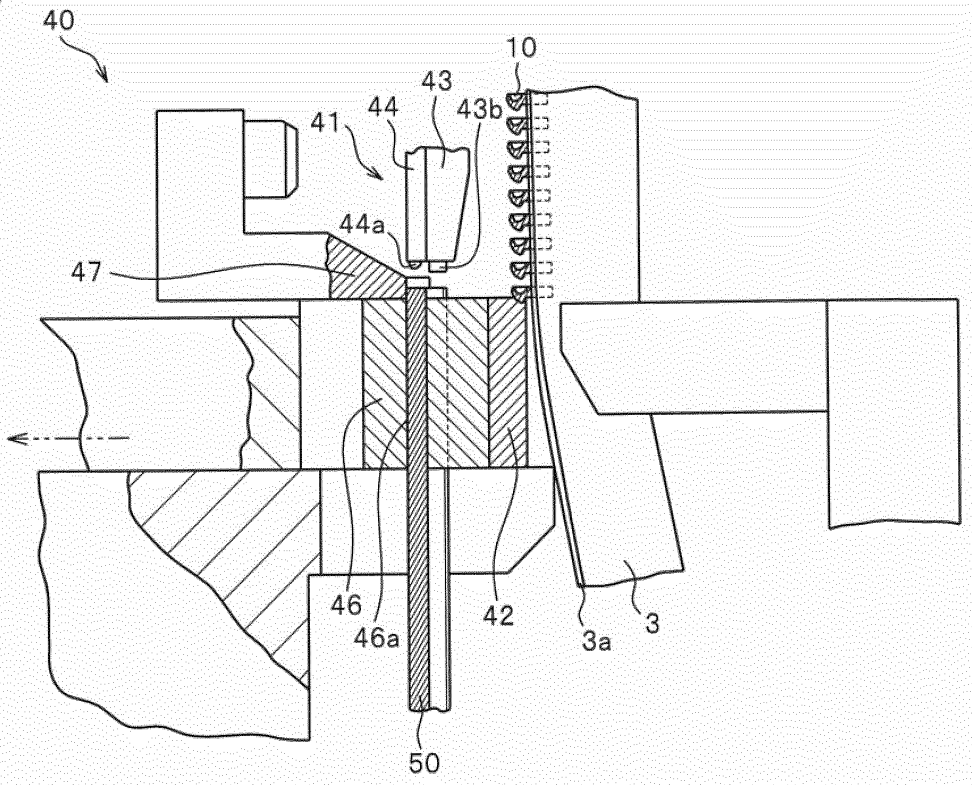

40
10
43
44
43b
41
44a
47
46
46a
42
3a
3
50

FIG.10

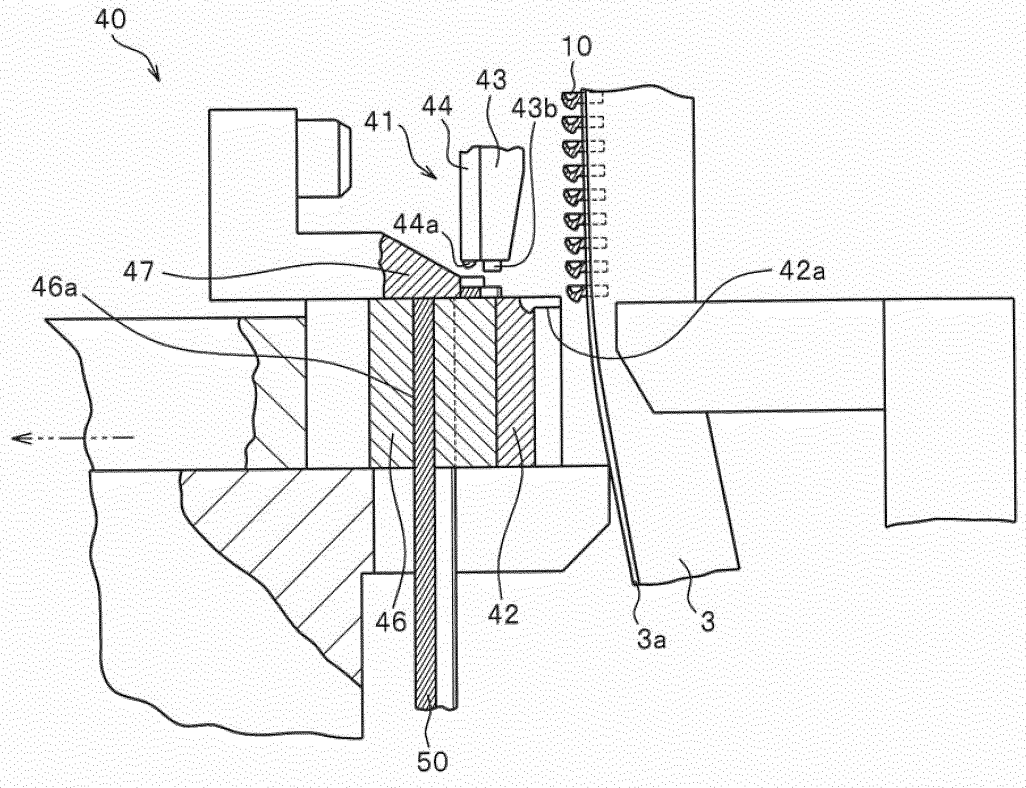

40
10
43
44
43b
41
44a
47
46a
42a
46
42
3a
3
50

FIG.11

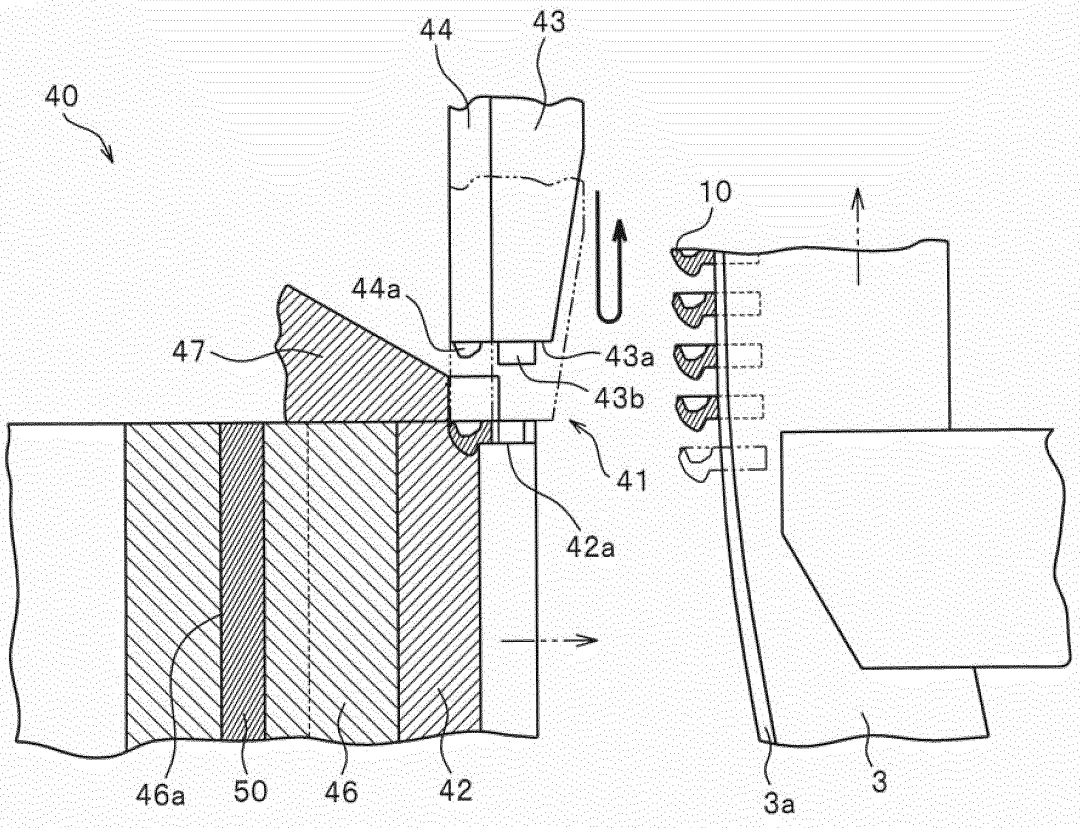


FIG.12

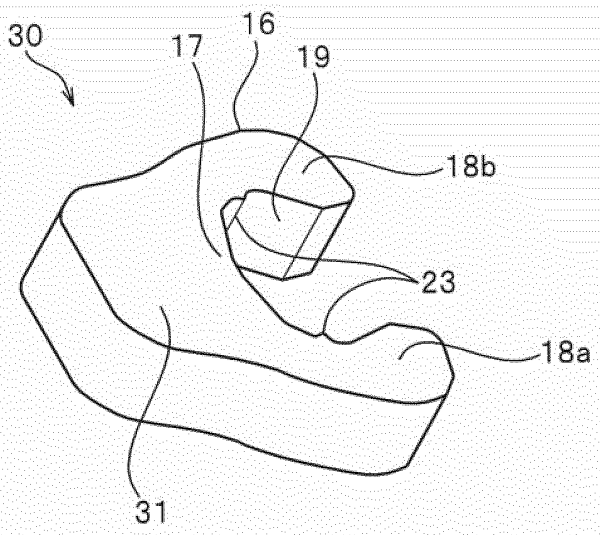
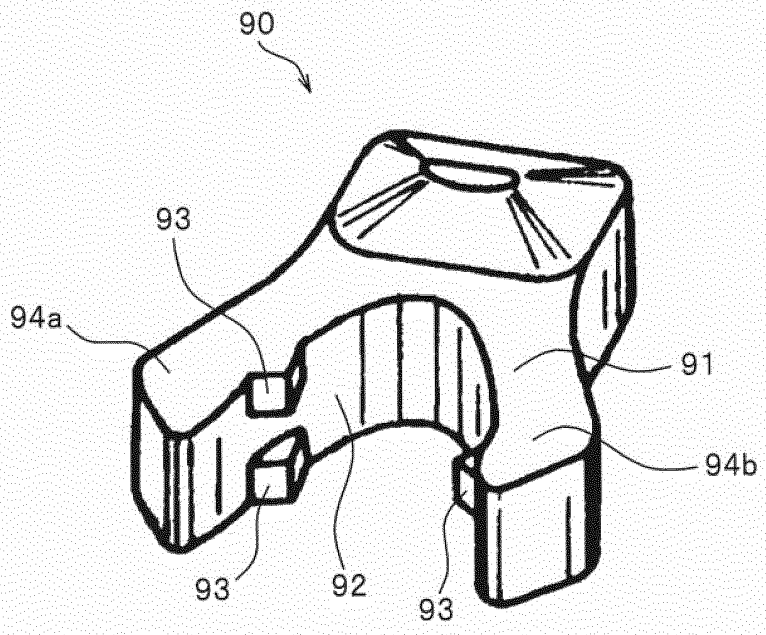


FIG.13



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2016/063679

A. CLASSIFICATION OF SUBJECT MATTER
A44B19/02(2006.01)i, *A44B19/42*(2006.01)i, *B21D53/50*(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A44B19/02, A44B19/42, B21D53/50

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2016
Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2008-212352 A (YKK Corp.), 18 September 2008 (18.09.2008), paragraphs [0022] to [0035]; fig. 1 to 5 & US 2008/0209695 A1 paragraphs [0031] to [0044]; fig. 1 to 5 & DE 102008011515 A1 & CN 101254041 A	1,2,4-6
A	JP 57-128106 A (Talon, Inc.), 09 August 1982 (09.08.1982), & US 4348789 A & GB 2086469 A	3,7-10
A	JP 51-055769 A (Tadao YOSHIDA), 17 May 1976 (17.05.1976), (Family: none)	3,7-10

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
08 July 2016 (08.07.16)	19 July 2016 (19.07.16)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2016/063679

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2015/049767 A1 (YKK Corp.), 09 April 2015 (09.04.2015), & TW 201521905 A	3,7-10
A	JP 57-048405 Y2 (Yoshida Kogyo Co., Ltd.), 23 October 1982 (23.10.1982), & US 4004327 A & GB 1478256 A	3,7-10

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REFERENCES CITED IN THE DESCRIPTION

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- JP 2744383 B **[0007] [0015]**
- WO 2015049767 A1 **[0007] [0015]**
- JP S5264106 B **[0011]**
- JP S5635052 B **[0011]**
- JP S5748405 B **[0011]**
- JP US5264106 A **[0015]**
- JP US5635052 B **[0015]**
- JP US5748405 B **[0015]**