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### FASTENER ELEMENT FOR SLIDE FASTENER, AND SLIDE FASTENER

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#### Abstract

A fastener element (21) for a metal slide fastener comprises: an interlocking head (30); and a first half (32) and a second half (33) that branch and extend from the interlocking head (30). The surfaces of the first half (32) and the second half (33) facing each other are provided with holding grooves (39) formed along the width direction of the fastener element. The branching of the first half (32) and the second half (33) is more toward the interlocking head than are the holding grooves (39a, 39b). As a result, it is possible to attach new fastener elements to missing fastener element sections at low cost and in a short time without sending the slide fastener to a repair shop, and also possible to achieve a satisfactory outer appearance.

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## Background/Summary

### TECHNICAL FIELD

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

### BACKGROUND ART

[0002] In the related art, in a state where left and right element rows mesh with each other and a slide fastener is closed, when an excessive lateral pulling force acts on left and right fastener stringers, a fastener element may be detached from a fastener tape or may be damaged. Therefore, a new fastener element is attached to repair a portion where the fastener element is missing due to the detachment or damage.

[0003] For example, Patent Literature 1 describes a manual injection molding machine capable of injection-molding a new fastener element to a portion where a fastener element is missing. Further, in a fastener element described in Patent Literature 2, a fastener tape is clamped by a pair of element half portions separated on a tape front surface side and a tape back surface side in a portion where the fastener element is damaged and missing, and a fastener element for repair is attached by performing fastening using mechanical fastening means such as a bolt member and a nut member.

[0004] Further, in the related art, there is also known a slide fastener in which a metal fastener element is molded by die casting by setting a mold on a fastener tape and making a molten metal flow into the mold (for example, see Patent Literature 3).

### CITATION LIST

Patent Literature

[0005] Patent Literature 1: JPS53-71661U [0006] Patent Literature 2: JP5430674B [0007] Patent Literature 3: JPH05-123209A

### SUMMARY OF INVENTION

#### Technical Problem

[0008] However, in a method of manufacturing a metal element or a resin element by die casting or injection molding, a dedicated molding machine is required, and clothes and the like requiring repair are required to be sent to a repair shop, and thus there is a problem in that a time and cost for repairing are increased.

[0009] Further, for the fastener element for repair disclosed in Patent Literature 2, a method for a large slide fastener whose aesthetic is not a concern such as those used for fishing nets is used, but is not preferred for applications where the aesthetic is required such as apparel, and improvement is desired.

[0010] The present invention has been made in view of the above-described circumstances, and an object of the present invention is to provide a fastener element for slide fastener which can be attached to a portion of a missing fastener element in a short time and at a low cost without being sent to a repair shop, and can have a good appearance, and a slide fastener.

#### Solution to Problem

[0011] The object of the present invention is achieved by the following configurations.

[0012] (1) A metal fastener element for a slide fastener including: [0013] a meshing head portion; and [0014] a first half portion and a second half portion which extend in a branched manner, in which [0015] each of the first half portion and the second half portion includes, in a surface thereof facing each other, a clamping groove extending along a width direction of the fastener element, and [0016] the first half portion and the second half portion are branched on a side of the meshing head portion with respect to the clamping grooves.

[0017] (2) The fastener element according to (1), in which an inner convex portion protruding into

a space formed by the clamping grooves is provided in each of the clamping grooves.

[0018] (3) The fastener element according to (1) or (2), further including a neck portion which is continuous from the meshing head portion and which is narrower than the meshing head portion, in which [0019] at least one of the first half portion and the second half portion is branched from a portion between a portion of the meshing head portion which is widest in the width direction of the fastener element and a portion of the neck portion which is narrowest in the width direction of the fastener element.

[0020] (4) The fastener element according to (3), further including a protrusion portion which protrudes from the meshing head portion and which is provided between the first half portion and the second half portion.

[0021] (5) The fastener element according to any one of (1) to (3), in which [0022] the first half portion includes a neck portion and a first leg portion which extends from the neck portion thereof to a side opposite to the meshing head portion and which is wider than the neck portion thereof, and/or the second half portion includes a neck portion and a second leg portion which extends from the neck portion thereof to the side opposite to the meshing head portion and which is wider than the neck portion thereof, [0023] a groove portion which extends along the width direction is formed in a front surface of the meshing head portion, and [0024] at least one of the first half portion and the second half portion includes a pair of shoulder portions extending in the width direction between the neck portion thereof and the first leg portion or the second leg portion and configured to be engaged with the groove portion.

[0025] (6) The fastener element according to (5), in which the shoulder portions are provided on any one of the first half portion and the second half portion.

[0026] (7) The fastener element according to any one of (2) to (6), in which the inner convex portion has a cross shape including a first inner convex portion which extends along the width direction and a second inner convex portion which intersects the first inner convex portion and which extends along a longitudinal direction.

[0027] (8) The fastener element according to (7), in which the second inner convex portion of the first half portion and the second inner convex portion of the second half portion are offset from each other in the width direction of the fastener element.

[0028] (9) The fastener element according to any one of (2) to (6), in which the inner convex portion includes at least three claw portions which are respectively provided at an intermediate portion in the width direction and both end portions in the width direction, and positions of the at least three claw portions in a length direction are different.

[0029] (10) The fastener element according to any one of (1) to (9), in which each of facing surfaces of the first half portion and the second half portion is provided with an outer convex portion on a side of the clamping grooves opposite to the meshing head portion.

[0030] (11) The fastener element according to any one of (1) to (10), in which a maximum opening distance between the first half portion and the second half portion is 85% to 90% of a diameter of a core string of the fastener tape.

[0031] (12) The fastener element according to any one of (1), (2), and (7) to (11), in which [0032] the meshing head portion includes a first head portion which is provided on a side of the first half portion in a front-back direction and which is tapered toward a front surface thereof, and a second head portion which is provided on a side of the second half portion in the front-back direction and which is wider than the first head portion, [0033] the first half portion includes a first leg portion which is formed continuously from the first head portion, and [0034] the second half portion includes a neck portion which is narrower than the second head portion, and a second leg portion which extends from the neck portion to a side opposite to the second head portion and which is wider than the neck portion.

[0035] (13) A slide fastener including: [0036] a pair of fastener stringers each formed by injection-molding a plurality of resin fastener elements on the fastener tape; and [0037] a slider configured to

open and close the pair of fastener stringers, in which [0038] in at least one of the pair of fastener stringers, the fastener element according to any one of (1) to (12) is crimped and attached to a tape side edge portion of the fastener tape between the resin fastener elements.

### Advantageous Effects of Invention

[0039] According to the fastener element for slide fastener and the slide fastener of the present invention, the fastener element can be attached to a portion of a missing fastener element in a short time and at a low cost without being sent to a repair shop, and can have a good appearance.

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## Description

### BRIEF DESCRIPTION OF DRAWINGS

[0040] FIG. 1 is a plan view of a slide fastener according to the present invention.

[0041] FIG. 2 is a perspective view of a fastener element according to a first embodiment of the present invention.

[0042] FIG. 3 is a plan view of the fastener element shown in FIG. 2.

[0043] FIG. 4 is a front view of the fastener element shown in FIG. 2 and a fastener tape.

[0044] FIG. 5 is a cross-sectional view taken along a line V-V in FIG. 4.

[0045] FIG. 6 is a cross-sectional view taken along a line VI-VI of FIG. 3.

[0046] FIG. 7 is a cross-sectional view showing a state where the fastener element is crimped to the fastener tape at a position along the line VI-VI in FIG. 3.

[0047] FIG. 8 is a front view of the fastener element after being crimped, excluding the fastener tape from FIG. 7.

[0048] FIG. 9 is a perspective view of a fastener element according to a second embodiment of the present invention.

[0049] FIG. 10 is a front view of the fastener element shown in FIG. 9.

[0050] FIG. 11 is a side view of the fastener element shown in FIG. 9.

[0051] FIG. 12 is a cross-sectional view taken along a line XII-XII in FIG. 10.

[0052] FIG. 13 is a cross-sectional view taken along a line XIII-XIII in FIG. 10.

[0053] FIG. 14 is a cross-sectional view showing a state where the fastener element is crimped to a fastener tape along the line XIII-XIII in FIG. 10.

[0054] FIG. 15 is a perspective view of a fastener element according to a third embodiment of the present invention.

[0055] FIG. 16 is a front view of the fastener element shown in FIG. 15.

[0056] FIG. 17 is a side view of the fastener element shown in FIG. 15.

[0057] FIG. 18 is a perspective view of a fastener element according to a fourth embodiment of the present invention.

[0058] FIG. 19 is a front view of the fastener element shown in FIG. 18.

[0059] FIG. 20 is a side view of the fastener element shown in FIG. 18.

[0060] FIG. 21 is a perspective view of a fastener element according to a fifth embodiment of the present invention.

[0061] FIG. 22 is a front view of the fastener element shown in FIG. 21.

[0062] FIG. 23 is a cross-sectional view taken along a line XXIII-XXIII in FIG. 22.

[0063] FIG. 24 is a perspective view of a fastener element according to a sixth embodiment of the present invention.

[0064] FIG. 25 is a front view of the fastener element shown in FIG. 24.

[0065] FIG. 26 (a) of FIG. 26 is a cross-sectional view taken along a line XXVI-XXVI of FIG. 25, and (b) of FIG. 26 is a cross-sectional view taken along a line XXVI'-XXVI' of FIG. 25.

[0066] FIG. 27 is a perspective view of a fastener element according to a seventh embodiment of the present invention.

[0067] FIG. **28** is a plan view of the fastener element shown in FIG. **27**.

[0068] FIG. **29** is a front view of the fastener element shown in FIG. **27**.

[0069] FIG. **30** (a) of FIG. **30** is a cross-sectional view taken along a line XXX-XXX in FIG. **29**.

[0070] FIG. **31** is a front view of the fastener element after being crimped, excluding a fastener tape from FIG. **27**.

## DESCRIPTION OF EMBODIMENTS

[0071] A fastener element for slide fastener and a slide fastener according to embodiments of the present invention will be described below.

[0072] In the following description, regarding the slide fastener, a direction in which a slider is slid to close left and right fastener stringers is referred to as an upper direction, and a direction in which the slider is slid to open the left and right fastener stringers is referred to as a lower direction.

Further, a direction perpendicular to the upper-lower direction and parallel to a fastener tape is referred to as a left-right direction, a right side in FIG. **1** is referred to as a right direction, a left side is referred to as a left direction, and in FIG. **1**, a front side of the paper is referred to as a front direction, and a back side of the paper is referred to as a back direction.

[0073] Further, regarding the fastener element, the left-right direction of the slide fastener is referred to as a longitudinal direction, and the upper-lower direction is referred to as a width direction. Further, regarding the longitudinal direction of the fastener element, a direction toward the facing fastener element is referred to as a front side, and a direction away from the facing fastener element is referred to as a rear side.

### First Embodiment

[0074] As shown in FIG. **1**, a slide fastener **10** includes a pair of left and right fastener stringers **11**, **12** and a slider **13** capable of opening and closing the fastener stringers **11**, **12**.

[0075] The left and right fastener stringers **11**, **12** include a pair of left and right fastener tapes **14**, element rows **15** provided on facing tape side edge portions **14c** of the pair of fastener tapes **14**, top stops **16** fixed to the tape side edge portions **14c** at upper ends of the element rows **15**, and a bottom stop **17** fixed to the tape side edge portions **14c** at lower ends of the element rows **15**. The top stop **16** and the bottom stop **17** prevent the slider **13** from falling off from the element rows **15**. The bottom stop **17** may be a separable end stop including a separable pin and a box body. In addition, the above-described configuration is an example, and the top stop **16** or the bottom stop **17** may not necessarily be provided.

[0076] Each of the fastener tapes **14** includes a tape portion **14a** and a core string **14b** provided on one side edge of the tape portion **14a**, and the core string **14b** and a part of the tape portion **14a** on a core string **14b** side serve as the tape side edge portion **14c**.

[0077] Each of the left and right element rows **15** is formed by a plurality of resin fastener elements **20** that are injection-molded on the tape side edge portion **14c** of the fastener tape **14**. For the resin fastener element **20**, a synthetic resin material such as polyacetal, polyethylene terephthalate, or nylon can be used.

[0078] In such a slide fastener **10**, in a state where the left and right element rows **15** are meshed with each other, when an excessive force is applied in a direction (left-right direction) to separate the left and right fastener stringers **11**, **12** from each other, the fastener elements **20** may be damaged, and a portion in which the fastener elements **20** are detached from the fastener tape **14** and are missing may be generated.

[0079] Therefore, as shown by shaded lines in FIG. **1**, a metal fastener element **21** of the present embodiment is attached by being crimped to a portion of the fastener tape **14** where the resin fastener element **20** is missing, and is used to repair the fastener stringers **11**, **12**.

[0080] As shown in FIGS. **2** to **6**, the fastener element **21** attached to the missing portion is made of a metal such as a copper alloy or a zinc alloy. The fastener element **21** includes a meshing head portion **30** which has a substantially elliptical shape in a planar view and in a front surface of which a groove portion **31** having a substantially U-shaped cross section extending along the width

direction is formed; and a first half portion **32** and a second half portion **33** that extend from a substantially center of the fastener element **21** in a front-back direction and branches into a substantially V shape.

[0081] The fastener element **21** further includes a neck portion **34** which is continuous from the meshing head portion **30** and is narrower than the meshing head portion **30**. As shown in FIG. 5, the neck portion **34** includes a portion B that has a narrowest width **WS** and that is narrowest in the width direction of the fastener element **21**. Meanwhile, the meshing head portion **30** includes, in front of the neck portion **34**, a portion A which is widest in the width direction of the fastener element **21**, which refers to at least a part forward than the portion A.

[0082] In the present embodiment, the first half portion **32** and the second half portion **33** are branched from between the portion A of the meshing head portion **30** shown in FIG. 5 which is widest in the width direction of the fastener element **21** and the portion B of the neck portion **34** which is narrowest in the width direction of the fastener element **21**. Specifically, a branch portion P where the first half portion **32** and the second half portion **33** branch is provided along the width direction of the fastener element **21** between the portion A and the portion B in the longitudinal direction of the fastener element **21**. The branch portion P where the first and second half portions **32**, **33** branch is located closer to a meshing head portion side than later-described clamping grooves **39a**, **39b** (see FIG. 4).

[0083] On the first half portion **32**, the neck portion **34**, and a first leg portion **35a** that extends from the neck portion **34** to a side opposite to the meshing head portion **30**, that is wider than the neck portion **34**, and that is substantially rectangular in a planar view, are formed. On the second half portion **33**, the neck portion **34**, and a second leg portion **35b** that extends from the neck portion **34** to the side opposite to the meshing head portion **30**, that is wider than the neck portion **34**, and that is substantially rectangular in a planar view, are formed.

[0084] Further, the first half portion **32** is provided with a pair of wing-shaped shoulder portions **36**, **36** extending in the width direction between the neck portion **34** and the first leg portion **35a**. Each of the pair of shoulder portions **36**, **36** is formed to straddle a center line C of the front-back direction (thickness) when the fastener element **21** is crimped and fixed to the fastener tape **14** as to be described later (see FIG. 8). Therefore, a thickness **W1** of the neck portion **34** of the first half portion **32** having the pair of shoulder portions **36**, **36** is formed to be thicker than a thickness **W2** of the neck portion **34** of the second half portion **33** (see FIG. 4).

[0085] In this case, the branch portion P where the first and second half portions **32**, **33** branch is located closer to the meshing head portion side than the pair of shoulder portions **36**.

[0086] The pair of shoulder portions **36**, **36** are engaged with the groove portions of the mating fastener elements **20** or **21** to be meshed, so as to prevent a positional displacement in the front-back direction. The pair of shoulder portions **36**, **36** can be formed on both the first half portion **32** and the second half portion **33** symmetrically in the front-back direction (see a fifth embodiment), but by forming the shoulder portions only on the first half portion **32** as described above, the thickness of the shoulder portion **36** is increased, making it easier to mold the fastener element **21**.

[0087] In the present embodiment, it is desired that a front-back direction center portion **29** of the meshing head portion **30** is mainly plastically deformed by crimping, which will be described later, and a flat appearance of a front surface **43** and a back surface **44** can be maintained even after crimping. Therefore, as in the present embodiment, the branch portion P is preferably located between the portion A of the meshing head portion **30** which is widest in the width direction of the fastener element **21** and the portion B of the neck portion **34** which is narrowest in the width direction of the fastener element **21**, and more preferably located forward than the pair of shoulder portions **36** in the longitudinal direction.

[0088] In facing surfaces of the leg portions **35a**, **35b** of the first and second half portions **32**, **33**, substantially U-shaped clamping grooves **39a**, **39b** each recessed in the front-back direction are provided along the width direction. The clamping grooves **39a**, **39b** of the first and second half

portions **32**, **33** cooperate with each other to accommodate the core string **14b** of the fastener tape **14**. Further, flat portions **37**, **38** are formed on the facing surfaces of the leg portions **35a**, **35b** at rear end portions (opening end portions) of the clamping grooves **39a**, **39b**, respectively, and the flat portions **37**, **38** clamp the tape portion **14a** when the fastener element **21** is crimped.

[0089] A maximum opening distance L between the pair of leg portions **35a**, **35b** opened in a substantially V shape is set to 85% to 90% of a diameter d of the core string **14b** of the fastener tape **14**. For example, when the diameter d of the core string **14b** is 1.30 mm to 1.40 mm, the maximum opening distance L is set to 1.2 mm, for example.

[0090] In each of the clamping grooves **39a**, **39b** of the first half portion **32** and the second half portion **33**, an inner convex portion **40** protruding into a space S formed by the clamping grooves **39a**, **39b** and capable of biting into the core string **14b** of the fastener tape **14** is provided.

Specifically, the inner convex portion **40** includes a substantially columnar first inner convex portion **41** protruding in the front-back direction from a bottom surface of each of the clamping grooves **39a**, **39b** and extending along the width direction across both side surfaces of each of the leg portions **35a**, **35b** in the width direction; and a rib-shaped second inner convex portion **42** perpendicularly intersecting the first inner convex portion **41** at a substantially center of the first inner convex portion **41** in a length direction thereof (width direction) and extending along the longitudinal direction across both wall surfaces of each of the clamping grooves **39a**, **39b** in the longitudinal direction. The first inner convex portion **41** and the second inner convex portion **42** intersect each other in a substantially cross shape at a substantially center of each of the clamping grooves **39a**, **39b**.

[0091] The metal fastener element **21** of the present embodiment is attached to a portion, where the resin fastener element **20** is missing from the fastener stringers **11**, **12**, using a crimping tool (not shown).

[0092] In this case, first, the tape side edge portion **14c** of the fastener tape **14** is inserted between the flat surfaces **37**, **38** of the pair of leg portions **35a**, **35b** opened in a V shape, and the core string **14b** is located between the pair of clamping grooves **39a**, **39b**. At this time, since the maximum opening distance L between the pair of leg portions **35a**, **35b** is set to 85% to 90% of the diameter d of the core string **14b** of the fastener tape **14**, the core string **14b** is inserted into the clamping groove **39a**, **39b** while being slightly compressed, and after the core string **14b** is temporarily fixed in the clamping grooves **39a**, **39b** before crimping, the fastener tape **14** can be prevented from falling off from between the pair of leg portions **35a**, **35b**.

[0093] Next, the metal fastener element **21** is positioned at a predetermined position in the width direction (upper-lower direction) such that the fastener elements **20**, **21**, and **20** have the same pitch between a pair of resin fastener elements **20** adjacent to the portion where the fastener element **20** is missing.

[0094] Then, by pressing the leg portions **35a**, **35b** of the first half portion **32** and the second half portion **33** from the front-back direction by the crimping tool, the front-back direction center portion **29** of the meshing head portion **30** is plastically deformed. Accordingly, as shown in FIG. 7, the tape portion **14a** is clamped by the flat portions **37**, **38** of the first half portion **32** and the second half portion **33**, and at the same time, the pair of inner convex portions **40** in the clamping grooves **39a**, **39b** are bitten into the core string **14b** of the fastener tape **14**, and the fastener element **21** is crimped and fixed to the fastener tape **14**. A center portion of the fastener tape **14** is pressed and deformed by the pair of inner convex portions **40**. In a state where the crimping is performed on the fastener tape **14**, a gap S1 is provided between a portion on a meshing head portion **30** side of the clamping grooves **39a**, **39b** and the branch portion P in the first half portion **32** and the second half portion **33** of the fastener element **21**. The core string **14b** is not provided in the gap S1. By providing the gap S1, damage or unintended deformation due to a force applied to the portion on the meshing head portion **30** side of the clamping grooves **39a**, **39b** in the crimping step can be prevented. This is also advantageous when the fastener element **21** is released from a mold.

[0095] Since the fastener tape **14** is clamped by plastically deforming the front-back direction center portion **29** of the meshing head portion **30**, as compared with a case where the first half portion **32** and the second half portion **33** are plastically deformed, the first half portion **32** and the second half portion **33** are deformed in a natural manner and maintain good appearance. That is, the front surface **43** from the meshing head portion **30** to the first half portion **32** and the back surface **44** from the meshing head portion **30** to the second half portion **33** after the crimping are flat and parallel to each other.

[0096] Since the first inner convex portion **41** of the inner convex portion **40** extends in the width direction in each of the clamping grooves **39a**, **39b** and clamps the core string **14b** in a length direction thereof, mainly, wobbling of the fastener element **21** due to a force in the left-right direction acting on the fastener element **21** can be prevented to improve stability, and further, the fastener element **21** is prevented from falling off from the fastener tape **14**. Further, since the rib-shaped second inner convex portion **42** clamps the core string **14b** from a direction intersecting the length direction, the fastener element **21** is mainly prevented from being displaced in the width direction (upper-lower direction) with respect to the fastener tape **14**. That is, the fastener element **21** is firmly fixed to the fastener tape **14** by an anchor effect of pressing and deforming the core string **14b** by the first inner convex portion **41** and the second inner convex portion **42** that have a cross shape.

[0097] As described above, according to the fastener element **21** of the present embodiment, the slide fastener **10** can be easily repaired by crimping and attaching the new metal fastener element **21** to the portion where the resin fastener element **20** is missing from the fastener tape **14**. Further, it is not necessary to send clothes or the like requiring repair to a factory, and the time and costs for repairing the damaged fastener element can be significantly reduced, and the repair can be easily performed in the field.

[0098] Further, since the metal fastener element **21** has substantially the same appearance as the resin fastener element **20**, an overall appearance of the slide fastener **10** including the metal fastener element **21** and the resin fastener element **20** can be maintained.

#### Second Embodiment

[0099] Next, a fastener element according to a second embodiment of the present invention will be described in detail with reference to FIGS. **9** to **14**.

[0100] In a fastener element **21A** according to the present embodiment, the second inner convex portion **42** of the first half portion **32** is formed to be offset from a width-direction center WC of the fastener element **21A** (see FIGS. **12** and **13**) to one side in the width direction. Meanwhile, the second inner convex portion **42** of the second half portion **33** is formed to be offset from the width-direction center WC of the fastener element **21A** toward another side in the width direction. That is, the second inner convex portion **42** of the first half portion **32** and the second inner convex portion **42** of the second half portion **33** are offset from each other in the width direction of the fastener element **21A**.

[0101] Accordingly, when the fastener element **21A** is crimped to the fastener tape **14**, as shown in FIG. **14**, the second inner convex portions **42** of the first half portion **32** and the second half portion **33** press the core string **14b** of the fastener tape **14** to deform the core string **14b** in a shearing direction. As a result, the fastener element **21A** can improve an effect of preventing a displacement of the fastener element **21A** in the width direction with respect to the fastener tape **14**.

[0102] Other configurations and effects are the same as those of the fastener element **21** according to the first embodiment.

#### Third Embodiment

[0103] Next, a fastener element according to a third embodiment of the present invention will be described in detail with reference to FIGS. **15** to **17**.

[0104] In addition to the configuration of the fastener element **21** according to the first embodiment, a fastener element **21B** according to the present embodiment further includes an outer



convex portion **50**. The outer convex portion **50** includes a first outer convex portion **51** extending in the width direction on the flat portion **37** of the first half portion **32** along an end portion on a meshing head portion **30** side (front side); and a second outer convex portion **52** extending in the width direction on the flat portion **38** of the second half portion **33** along an end portion on a side (rear side) opposite to the meshing bead portion **30**. The first outer convex portion **51** and the second outer convex portion **52** are formed at positions apart from each other in the longitudinal direction when viewed from the front-back direction.

[0105] When the fastener element **21B** is crimped and fixed to the fastener tape **14**, in addition to a fixing force from the inner convex portions **40**, **40** in the clamping grooves **39a**, **39b**, the tape portion **14a** is deformed in a substantially crank shape in the left-right direction and clamped by the first outer convex portion **51** and the second outer convex portion **52**, so that the fixing force is further strengthened and it is difficult for the fastener element **21B** to come off from the fastener tape **14**. Further, since the tape portion **14a** is clamped by the first outer convex portion **51** and the second outer convex portion **52** over an entire length of each of the leg portions **35a**, **35b** in the width direction, in addition to the effects of the fastener element **21** of the first embodiment, the wobbling of the fastener element **21B** with respect to the fastener tape **14** (rotation in a plane of the fastener tape **14**) can be further prevented.

#### Fourth Embodiment

[0106] Next, a fastener element according to a fourth embodiment of the present invention will be described in detail with reference to FIGS. **18** to **20**.

[0107] A fastener element **21C** according to the present embodiment includes an outer convex portion **55** having a shape different from that of the outer convex portion **50** of the fastener element **21B** of the third embodiment.

[0108] The outer convex portion **55** includes a first outer convex portion **56** provided on the flat portion **37** of the first half portion **32** and a second outer convex portion **57** provided on the flat portion **38** of the second half portion **33**. In the first outer convex portion **56**, a part of the flat portion **37** of the first half portion **32** on one side in the width direction is provided to protrude toward the flat portion **38**, and in the second outer convex portion **57**, a part of the flat portion **38** of the second half portion **33** on another side in the width direction is provided to protrude toward the flat portion **37**. The first outer convex portion **56** and the second outer convex portion **57** are formed at positions apart from each other in the width direction when viewed from the front-back direction.

[0109] When the fastener element **21C** is crimped and fixed to the fastener tape **14**, the tape portion **14a** is deformed in a substantially crank shape in the upper-lower direction and firmly clamped by the first outer convex portion **56** and the second outer convex portion **57**. Further, since the tape portion **14a** is clamped over an entire length of each of the leg portions **35a**, **35b** in the width direction, similar to the fastener element **21B** of the third embodiment, the wobbling of the fastener element **21C** with respect to the fastener tape **14** can be prevented.

#### Fifth Embodiment

[0110] Next, a fastener element according to a fifth embodiment of the present invention will be described in detail with reference to FIGS. **21** to **23**.

[0111] A fastener element **21D** of the present embodiment includes an inner convex portion **60** including three claw portions **61a**, **62a**, **63a** and an inner convex portion **60** including three claw portions **61b**, **62b**, **63b** which form a pair, instead of the pair of inner convex portions **40** in the fastener element **21** according to the first embodiment.

[0112] The inner convex portion **60** of the first half portion **32** includes a first claw portion **61a**, a second claw portion **62a**, and a third claw portion **63a** which are provided in the clamping groove **39a**, and the inner convex portion **60** of the second half portion **33** includes a first claw portion **61b**, a second claw portion **62b**, and a third claw portion **63b** which are provided in the clamping groove **39b**.

[0113] The first claw portion **61a** and the first claw portion **61b** are provided apart from each other in the longitudinal direction respectively at one end portions of the clamping grooves **39a**, **39b** in the width direction (a front side of the paper in FIG. 22), the first claw portion **61a** is formed in the clamping groove **39a** closer to the meshing head portion **30**, and the first claw portion **61b** is formed in the clamping groove **39b** closer to an opening-side end portion. The second claw portion **62a** and the second claw portion **62b** are provided to face each other in the front-back direction at intermediate portions of the clamping grooves **39a**, **39b** in the width direction and in the longitudinal direction. Further, the third claw portion **63a** and the third claw portion **63b** are provided apart from each other in the longitudinal direction at the other end portions of the clamping grooves **39a**, **39b** in the width direction (a deep side of the paper in FIG. 22), the third claw portion **63a** is formed in the clamping groove **39a** closer to an opening end portion, and the third claw portion **63b** is formed in the clamping groove **39b** closer to the meshing head portion **30**. The first claw portions **61a**, **61b** and the third claw portions **63a**, **63b** are integrally formed from bottom surfaces of the clamping grooves **39a**, **39b** to side surfaces in the longitudinal direction.

[0114] Accordingly, when the fastener element **21D** of the present embodiment is crimped and fixed to the fastener tape **14**, the core string **14b** is clamped between the first claw portions **61a**, **61b**, between the second claw portions **62a**, **62b**, and between the third claw portions **63a**, **63b** at different positions in the width direction and in a balanced manner at three portions different in clamping direction, and the fastener tape **14** is firmly held.

[0115] In the fastener element **21D** of the present embodiment, the shoulder portion **36** described in the first embodiment (see FIG. 3) is divided into two parts including a first shoulder portion **36a** and a second shoulder portion **36b**. Specifically, a pair of the first shoulder portions **36a** extends in the width direction in a wing shape between the neck portion **34** and the first leg portion **35a** of the first half portion **32**, and a pair of the second shoulder portions **36b** extends in the width direction in a wing shape between the neck portion **34** and the second leg portion **35b** of the second half portion **33**.

[0116] Then, when the fastener element **21D** is crimped and fixed to the fastener tape **14**, the shoulder portion **36** is formed in which the first shoulder portion **36a** and the second shoulder portion **36b** are overlapped and fitted in the groove portion **31**.

[0117] Other configurations and effects are the same as those of the fastener element **21** of the first embodiment.

#### Sixth Embodiment

[0118] Next, a fastener element according to a sixth embodiment of the present invention will be described in detail with reference to FIGS. 24 to 26.

[0119] A fastener element **21E** of the present embodiment includes the meshing head portion **30**, and the first half portion **32** and the second half portion **33** branching from a substantially center of the meshing head portion **30** in the front-back direction into a substantially V-shape. The meshing head portion **30** includes a first head portion **30a** formed on a first half portion **32** side and a second head portion **30b** formed on a second half portion **33** side. The first head portion **30a** is formed in a substantially triangular shape that is tapered toward a front surface thereof, and the second head portion **30b** is wider than the first head portion **30a** and has a substantially elliptical shape in a planar view.

[0120] Further, in the first half portion **32**, the first leg portion **35a** having a substantially rectangular shape in a planar view is formed continuously from the first head portion **30a**. In the second half portion **33**, the neck portion **34** continuous from the second head portion **30b** and narrower than the second head portion **30b** is continuously formed by hanging from the second head portion **30b**. Further, the second leg portion **35b** that extends from the neck portion **34** to a side opposite to the second head portion **30b**, that is wider than the neck portion **34**, and that has a substantially rectangular shape in a planar view, is formed. That is, the second head portion **30b** and the second half portion **33** (the neck portion **34** and the second leg portion **35b**) have shapes similar

to those of a half portion of the meshing head portion **30**, the neck portion **34**, and the second leg portion **35b** of the first embodiment. The first leg portion **35a** of the first half portion **32** faces the neck portion **34** and the second leg portion **35b** of the second half portion **33**.

[0121] Further, the fastener element **21E** of the present embodiment does not include the groove portion **31** and the shoulder portion **36** described in the first embodiment, and when the left and right element rows **15** mesh with each other, a front surface **65** of the second head portion **30b** of the fastener element **21E** and a back surface **66** of the first leg portion **35a** of the first head portion **30a** are respectively abutted against a back surface of the leg portion of the first head portion of another fastener element **20** and a front surface of the second head portion, thereby preventing a positional displacement in the front-back direction.

[0122] Similar to the first embodiment, the substantially U-shaped clamping grooves **39a**, **39b** are provided to extend in the width direction respectively in facing surfaces of the leg portions **35a**, **35b** of the first half portion **32** and the second half portion **33**. The flat portions **37**, **38** are respectively formed on the facing surfaces of the leg portions **35a**, **35b** at rear end portions (opening end portions) of the clamping grooves **39a**, **39b**. In each of the clamping grooves **39a**, **39b** of the first half portion **32** and the second half portion **33**, the inner convex portion **40** including the first inner convex portion **41** and the second inner convex portion **42** that can bite into the core string **14b** of the fastener tape **14**, is provided.

[0123] In such a fastener element **21E** in which the meshing head portion **30** has different shapes in the front-back direction, since the first half portion **32** and the second half portion **33** respectively include the clamping grooves **39a**, **39b** each having the inner convex portion **40** on the surfaces **37**, **38** facing each other, the inner convex portions **40** also press and deform the core string **14b** when the crimping is performed, and the fastener element **21** is also firmly fixed to the fastener tape **14**.

[0124] Other configurations and effects are the same as those of the fastener element **21** of the first embodiment.

[0125] For example, the above description is made in which in the clamping grooves **39a**, **39b**, the inner convex portion **40** (the first inner convex portion **41** and the second inner convex portion **42**) is provided, but the convex portion in the clamping grooves **39a**, **39b** is not limited to the inner convex portion **40**, may be the outer convex portions **50**, **55** and the inner convex portion **60** described in the second embodiment to fifth embodiment, or may be a combination of the convex portions.

#### Seventh Embodiment

[0126] Next, a fastener element according to a seventh embodiment of the present invention will be described in detail with reference to FIGS. **27** to **31**.

[0127] In a fastener element **21F** of the present embodiment, a wing-shaped protrusion portion **26** is provided to protrude from the meshing head portion **30** between the first half portion **32** and the second half portion **33**, separately from the first half portion **32** and the second half portion **33**.

[0128] That is, the protrusion portion **26** includes a base portion **28** that extends rearward from a rear surface of the front-back direction center portion **29** of the meshing head portion **30**, and a pair of shoulder portions **36** that extend from a tip end portion of the base portion **28** to both sides in the width direction of the slide fastener, and is formed in a substantially T-shape by the base portion **28** and the pair of shoulder portions **36**.

[0129] In the fastener element **21F** having such a protrusion portion **26**, since a stress generated when the fastener element **21F** is crimped as shown in FIG. **31** is dispersed at three portions including the groove portion **31** of the meshing head portion **30**, and the neck portions **34** of the first half portion **32** and the second half portion **33**, occurrence of crimping cracks can be prevented.

[0130] As shown in FIG. **29**, hollowed-out portions **34a** whose inner surfaces facing each other are hollowed out are respectively formed in the neck portions **34** of the first half portion **32** and the second half portion **33**, and a thickness of each of the neck portions **34** is reduced.

[0131] Accordingly, at the neck portions **34** of the first half portion **32** and the second half portion **33**, a stress generated when the fastener element **21F** is crimped is increased due to the hollowed-out portions **34a**, so that stress concentration in the groove portion **31** of the meshing head portion **30** can be dispersed more reliably.

[0132] Further, in the present embodiment, a step portion **27** forming a front surface of each of the clamping grooves **39a**, **39b** is formed at substantially the same height as the hollowed-out portion **34a**, but the present invention is not limited thereto, and for example, the step portion **27** may protrude inward than the hollowed-out portion **34a** at substantially the same height as the second inner convex portion **42**.

[0133] Regardless of the height to which the step portion **27** is formed, there is no substantial effect on a functional aspect in fixing the fastener element **21F** to the fastener tape **14** (see FIG. 7) by crimping. However, during manufacturing of the fastener element **21F** such as a surface treatment step, it is preferable that the height of the step portion **27** is formed to be substantially the same as a height of the hollowed-out portion **34a** in order to prevent two fastener elements **21F** before being crimped from being engaged with each other naturally and becoming difficult to separate.

[0134] Other configurations and effects are the same as those of the fastener element **21** of the first embodiment.

[0135] The present invention is not limited to each of the embodiments described above, and can be appropriately changed without departing from the gist of the present invention.

[0136] For example, in the above embodiments, a description is made in which one of the metal fastener elements **21** to **21E** is attached to repair the portion which the resin fastener element **20** is missing. However, the present invention is not limited thereto, and for example, a slide fastener considering design properties may be configured in which the resin fastener element **20** and one of the metal fastener elements **21** to **21E** are mixed by manufacturing the resin fastener stringers **11**, **12** in a state where the resin fastener element **20** is missing in advance, and attaching one of the metal fastener elements **21** to **21E** to the missing portion.

[0137] Further, the fastener elements **21** to **21E** may be kept in a metal color of the material, and may also be changed to another color by being subjected to a surface treatment such as plating.

[0138] Further, in the embodiments described above, a description is made in which the inner convex portion **40** or **60** in each of the clamping grooves **39a**, **39b** has the first inner convex portion **41** and the second inner convex portion **42** having a cross shape, or the claw portions **61a**, **61b**, **62a**, **62b**, **63a**, **63b**. However, the inner convex portion of the present invention is not limited thereto, and may have another shape as long as the inner convex portion protrudes into the space **S** formed by the clamping grooves **39a**, **39b** and can bite into the core string **14b** of the fastener tape **14**.

[0139] As described above, the following matters are disclosed in this specification.

[0140] (1) A metal fastener element for a slide fastener including: [0141] a meshing head portion; and [0142] a first half portion and a second half portion which extend in a branched manner, in which [0143] each of the first half portion and the second half portion includes, in a surface thereof facing each other, a clamping groove extending along a width direction and configured to accommodate a core string of the fastener tape, and [0144] the first half portion and the second half portion are branched on a side of the meshing head portion with respect to the clamping grooves.

[0145] According to the configuration, the fastener element can be attached to a portion of a missing fastener element in a short time and at a low cost without being sent to a repair shop, and since the first half portion and the second half portion are branched on the meshing head portion side of the clamping grooves, the fastener element can have a good appearance even when crimped.

[0146] (2) The fastener element according to (1), in which an inner convex portion protruding into a space formed by the clamping grooves is provided in each of the clamping grooves.

[0147] According to the configuration, the fastener element can be firmly fixed to the fastener tape.

[0148] (3) The fastener element according to (1) or (2), further including a neck portion which is

continuous from the meshing head portion and which is narrower than the meshing head portion, in which [0149] at least one of the first half portion and the second half portion is branched from a portion between a portion of the meshing head portion which is widest in the width direction of the fastener element and a portion of the neck portion which is narrowest in the width direction of the fastener element.

[0150] According to the configuration, since the first half portion and the second half portion are branched between the widest portion of the meshing head portion and the narrowest portion of the neck portion, the fastener element can be easily deformed in a natural manner when crimped, and has a good appearance.

[0151] (4) The fastener element according to (3), further including a protrusion portion which protrudes from the meshing head portion and which is provided between the first half portion and the second half portion.

[0152] According to the configuration, since the protrusion portion is divided from the first half portion and the second half portion, stress during crimping is dispersed to the meshing head portion and the neck portions of the first half portion and second half portion, thereby preventing crimping cracks.

[0153] (5) The fastener element according to any one of (1) to (3), in which [0154] the first half portion includes a neck portion and a first leg portion which extends from the neck portion thereof to a side opposite to the meshing head portion and which is wider than the neck portion thereof, and/or the second half portion includes a neck portion and a second leg portion which extends from the neck portion thereof to the side opposite to the meshing head portion and which is wider than the neck portion thereof, [0155] a groove portion which extends along the width direction is formed in a front surface of the meshing head portion, and [0156] at least one of the first half portion and the second half portion includes a pair of shoulder portions extending in the width direction between the neck portion thereof and the first leg portion or the second leg portion and configured to be engaged with the groove portion.

[0157] According to the configuration, the metal fastener element including the meshing head portion, the neck portion, and the leg portion on both sides in the front-back direction can be applied to a slide fastener including a resin fastener element having the same shape.

[0158] (6) The fastener element according to (5), in which the shoulder portions are provided on any one of the first half portion and the second half portion.

[0159] According to the configuration, a thickness of each of the shoulder portions can be increased, and the fastener element can be easily molded.

[0160] (7) The fastener element according to any one of (2) to (6), in which the inner convex portion has a cross shape including a first inner convex portion which extends along the width direction and a second inner convex portion which intersects the first inner convex portion and which extends along a longitudinal direction.

[0161] According to the configuration, the fastener element can be firmly fixed to the fastener tape, and a displacement of the fastener element in at least the width direction can be prevented.

[0162] (8) The fastener element according to (7), in which the second inner convex portion of the first half portion and the second inner convex portion of the second half portion are offset from each other in the width direction of the fastener element.

[0163] According to the configuration, an effect of preventing a displacement of the fastener element in the width direction with respect to the fastener tape can be improved.

[0164] (9) The fastener element according to any one of (2) to (6), in which the inner convex portion includes at least three claw portions which are respectively provided at an intermediate portion in the width direction and both end portions in the width direction, and positions of the at least three claw portions in a length direction are different.

[0165] According to the configuration, the fastener element can be firmly fixed to the fastener tape, and displacements of the fastener element in the longitudinal direction and the width direction can

be prevented.

[0166] (10) The fastener element according to any one of (1) to (9), in which each of facing surfaces of the first half portion and the second half portion is provided with an outer convex portion on a side of the clamping grooves opposite to the meshing head portion.

[0167] According to the configuration, the fastener element can be more firmly fixed to the fastener tape, and wobbling of the fastener element can be prevented.

[0168] (11) The fastener element according to any one of (1) to (10), in which a maximum opening distance between the first half portion and the second half portion is 85% to 90% of a diameter of a core string of the fastener tape.

[0169] According to the configuration, after the core string is temporarily fixed in the clamping grooves before crimping, the fastener tape can be prevented from falling off from a portion between the pair of leg portions.

[0170] (12) The fastener element according to any one of (1), (2), and (7) to (11), in which [0171] the meshing head portion includes a first head portion which is provided on a side of the first half portion in a front-back direction and which is tapered toward a front surface thereof, and a second head portion which is provided on a side of the second half portion in the front-back direction and which is wider than the first head portion, [0172] the first half portion includes a first leg portion which is formed continuously from the first head portion, and [0173] the second half portion includes a neck portion which is narrower than the second head portion, and a second leg portion which extends from the neck portion to a side opposite to the second head portion and which is wider than the neck portion.

[0174] According to the configuration, the metal fastener element including the meshing head portion and the leg portion on one side in the front-back direction and including the meshing head portion, the neck portion, and the leg portion on another side in the front-back direction can be applied to a slide fastener including a resin fastener element having the same shape.

[0175] (13) A slide fastener including: [0176] a pair of fastener stringers each formed by injection-molding a plurality of resin fastener elements on the fastener tape; and [0177] a slider configured to open and close the pair of fastener stringers, in which [0178] in at least one of the pair of fastener stringers, the fastener element according to any one of (1) to (12) is crimped and attached to a tape side edge portion of the fastener tape between the resin fastener elements.

[0179] According to the configuration, it is possible to obtain a slide fastener including a fastener element which can be attached to a portion of a missing fastener element in a short time and at a low cost without being sent to a repair shop, and which has a good appearance even when crimped.

[0180] The present application is based on an international patent application

(PCT/JP2022/012478) filed on Mar. 17, 2022, the contents of which are incorporated by reference into this application.

## REFERENCE SIGNS LIST

[0181] **10**: slide fastener [0182] **11, 12**: fastener stringer [0183] **13**: slider [0184] **14**: fastener tape [0185] **14a**: tape portion [0186] **14b**: core string [0187] **14c**: tape side edge portion [0188] **20** resin fastener element [0189] **21, 21A, 21B, 21C, 21E**: metal fastener element [0190] **30**: meshing head portion [0191] **30a**: first head portion [0192] **30b**: second head portion [0193] **31**: groove portion [0194] **32**: first half portion [0195] **33**: second half portion [0196] **34**: neck portion [0197] **35a**: first leg portion [0198] **35b**: second leg portion [0199] **36, 36a**: shoulder portion [0200] **37, 38**: flat portion [0201] **39a, 39b**: clamping groove [0202] **40, 60**: inner convex portion [0203] **41**: first inner convex portion [0204] **42**: second inner convex portion [0205] **50, 55**: outer convex portion [0206] **61a, 62a, 63a, 61b, 62b, 63b**: claw portion [0207] **d**: diameter of core string [0208] **L**: maximum opening distance between first half portion and second half portion [0209] **S**: space

## Claims

1. A metal fastener element (**21**, **21A**, **21B**, **21C**, **21D**, **21E**, **21F**) for a slide fastener comprising: a meshing head portion (**30**); and a first half portion (**32**) and a second half portion (**33**) which extend in a branched manner, wherein each of the first half portion and the second half portion includes, in a surface thereof facing each other, a clamping groove (**39a**, **39b**) extending along a width direction of the fastener element, and the first half portion and the second half portion are branched on a side of the meshing head portion (**30**) with respect to the clamping grooves (**39a**, **39b**).
2. The fastener element (**21**, **21A**, **21B**, **21C**, **21D**, **21E**, **21F**) according to claim 1, wherein an inner convex portion (**40**, **60**) protruding into a space(S) formed by the clamping grooves is provided in each of the clamping grooves (**39a**, **39b**).
3. The fastener element (**21**, **21A**, **21B**, **21C**, **21D**, **21E**, **21F**) according to claim 1 or 2, further comprising a neck portion (**34**) which is continuous from the meshing head portion (**30**) and which is narrower than the meshing head portion (**30**), wherein at least one of the first half portion (**32**) and the second half portion (**33**) is branched from a portion between a portion of the meshing head portion (**30**) which is widest in the width direction of the fastener element and a portion of the neck portion (**34**) which is narrowest in the width direction of the fastener element.
4. The fastener element (**21F**) according to claim 3, further comprising a protrusion portion (**26**) which protrudes from the meshing head portion (**30**) and which is provided between the first half portion (**32**) and the second half portion (**33**).
5. The fastener element (**21**, **21A**, **21B**, **21C**, **21D**) according to any one of claims 1 to 3, wherein the first half portion includes a neck portion (**34**) and a first leg portion (**35a**) which extends from the neck portion thereof to a side opposite to the meshing head portion and which is wider than the neck portion thereof, and/or the second half portion includes a neck portion (**34**) and a second leg portion (**35b**) which extends from the neck portion thereof to the side opposite to the meshing head portion and which is wider than the neck portion thereof, a groove portion (**31**) which extends along the width direction is formed in a front surface of the meshing head portion, and at least one of the first half portion and the second half portion includes a pair of shoulder portions (**36**) extending in the width direction between the neck portion thereof and the first leg portion or the second leg portion and configured to be engaged with the groove portion.
6. The fastener element (**21**, **21A**, **21B**, **21C**, **21D**) according to claim 5, wherein the shoulder portions are provided on any one of the first half portion and the second half portion.
7. The fastener element (**21**, **21A**, **21B**, **21C**, **21E**, **21F**) according to any one of claims 2 to 6, wherein the inner convex portion (**40**) has a cross shape including a first inner convex portion (**41**) which extends along the width direction and a second inner convex portion (**42**) which intersects the first inner convex portion and which extends along a longitudinal direction.
8. The fastener element (**21A**) according to claim 7, wherein the second inner convex portion (**42**) of the first half portion and the second inner convex portion (**42**) of the second half portion are offset from each other in the width direction of the fastener element.
9. The fastener element (**21D**) according to any one of claims 2 to 6, wherein the inner convex portion (**60**) includes at least three claw portions (**61a**, **62a**, **63a**, **61b**, **62b**, **63b**) which are respectively provided at an intermediate portion in the width direction and both end portions in the width direction, and positions of the at least three claw portions in a length direction are different.
10. The fastener element (**21B**, **21C**) according to any one of claims 1 to 9, wherein each of facing surfaces of the first half portion and the second half portion is provided with an outer convex portion (**50**, **55**) on a side of the clamping grooves opposite to the meshing head portion.
11. The fastener element (**21**, **21A**, **21B**, **21C**, **21D**, **21E**, **21F**) according to any one of claims 1 to 10, wherein a maximum opening distance (L) between the first half portion and the second half portion is 85% to 90% of a diameter (d) of a core string of the fastener tape.
12. The fastener element (**21E**) according to any one of claims 1, 2, and 7 to 11, wherein the meshing head portion includes a first head portion (**30a**) which is provided on a side of the first

half portion in a front-back direction and which is tapered toward a front surface thereof, and a second head portion (30b) which is provided on a side of the second half portion in the front-back direction and which is wider than the first head portion, the first half portion includes a first leg portion (35a) which is formed continuously from the first head portion, and the second half portion includes a neck portion (34) which is narrower than the second head portion, and a second leg portion (35b) which extends from the neck portion to a side opposite to the second head portion and which is wider than the neck portion.

**13.** A slide fastener (10) comprising: a pair of fastener stringers (11, 12) each formed by injection-molding a plurality of resin fastener elements (20) on the fastener tape; and a slider (13) configured to open and close the pair of fastener stringers, wherein in at least one of the pair of fastener stringers, the fastener element (21, 21A, 21B, 21C, 21D, 21E, 21F) according to any one of claims 1 to 12 is crimped and attached to a tape side edge portion of the fastener tape between the resin fastener elements.

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