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(54) CABLE TIE

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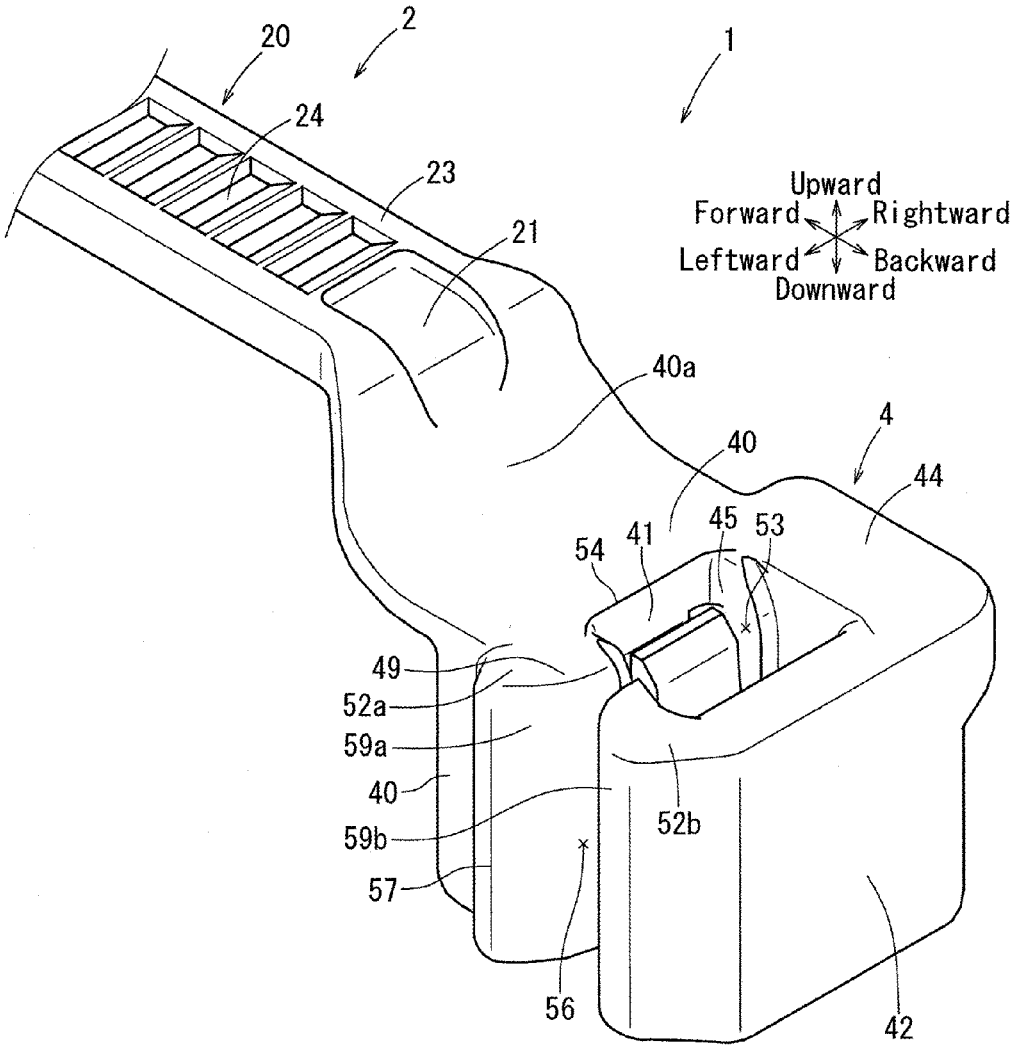
CPC *B65D 63/1027* (2013.01); *H01B 7/0045* (2013.01)

(57) ABSTRACT

A cable tie may include a desired length of belt configured to be wrapped around a bundle of tied articles, and a buckle connected to a proximal end portion of the belt and having a belt insertion hole. The belt includes a base portion linearly extending from the buckle and a functional portion having a first linear portion and a second linear portion. The first linear portion is connected to a distal end of the base portion at a proximal end thereof. The second linear portion is connected to a distal end of the first liner portion at a proximal end thereof. The first linear portion is inclined at a first angle with respect to the base portion in a belt wrapping direction. The second linear portion is inclined at a second angle with respect to the first liner portion in the belt wrapping direction. The first angle is determined to be equal to or smaller than the second angle.



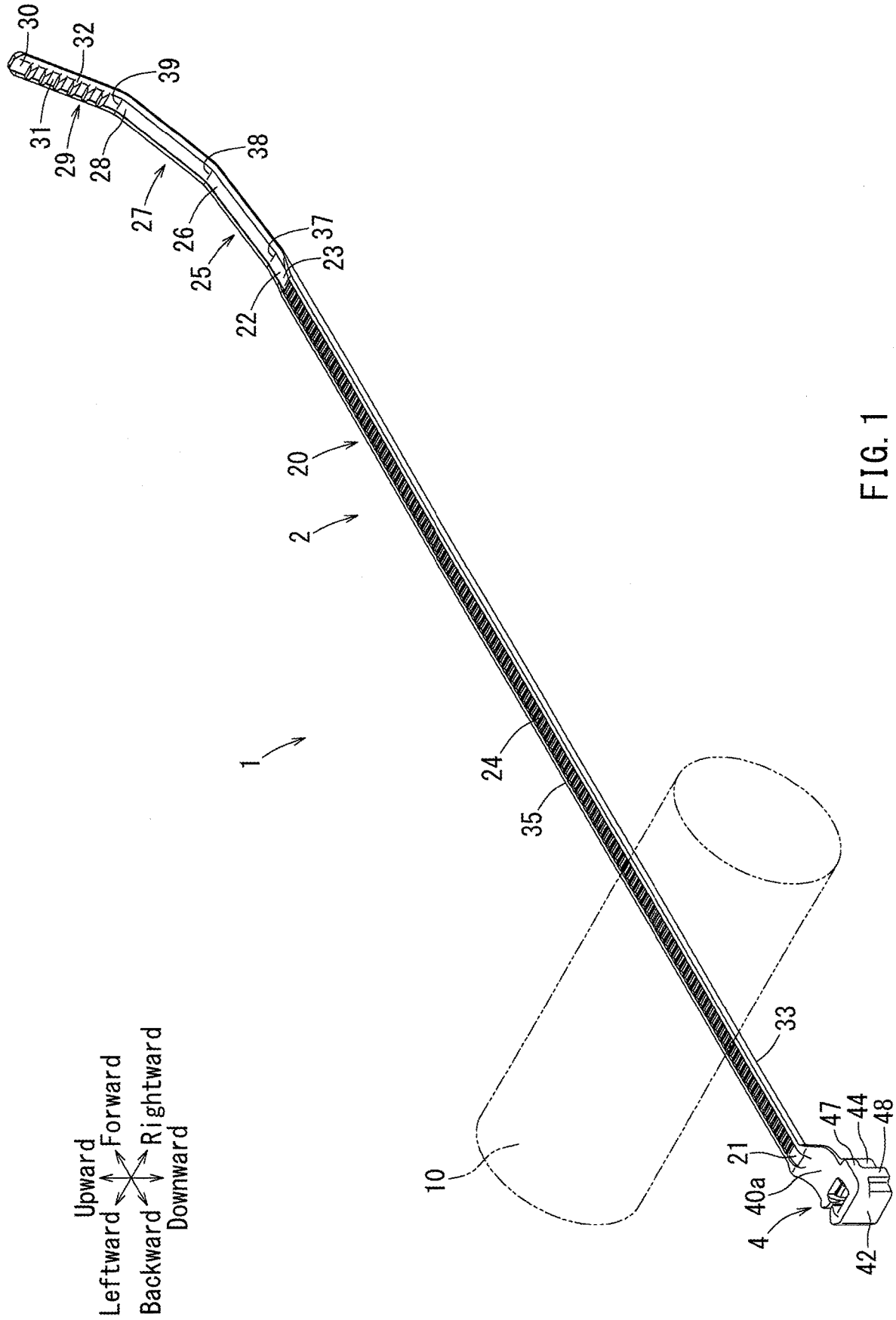

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FIG. 1

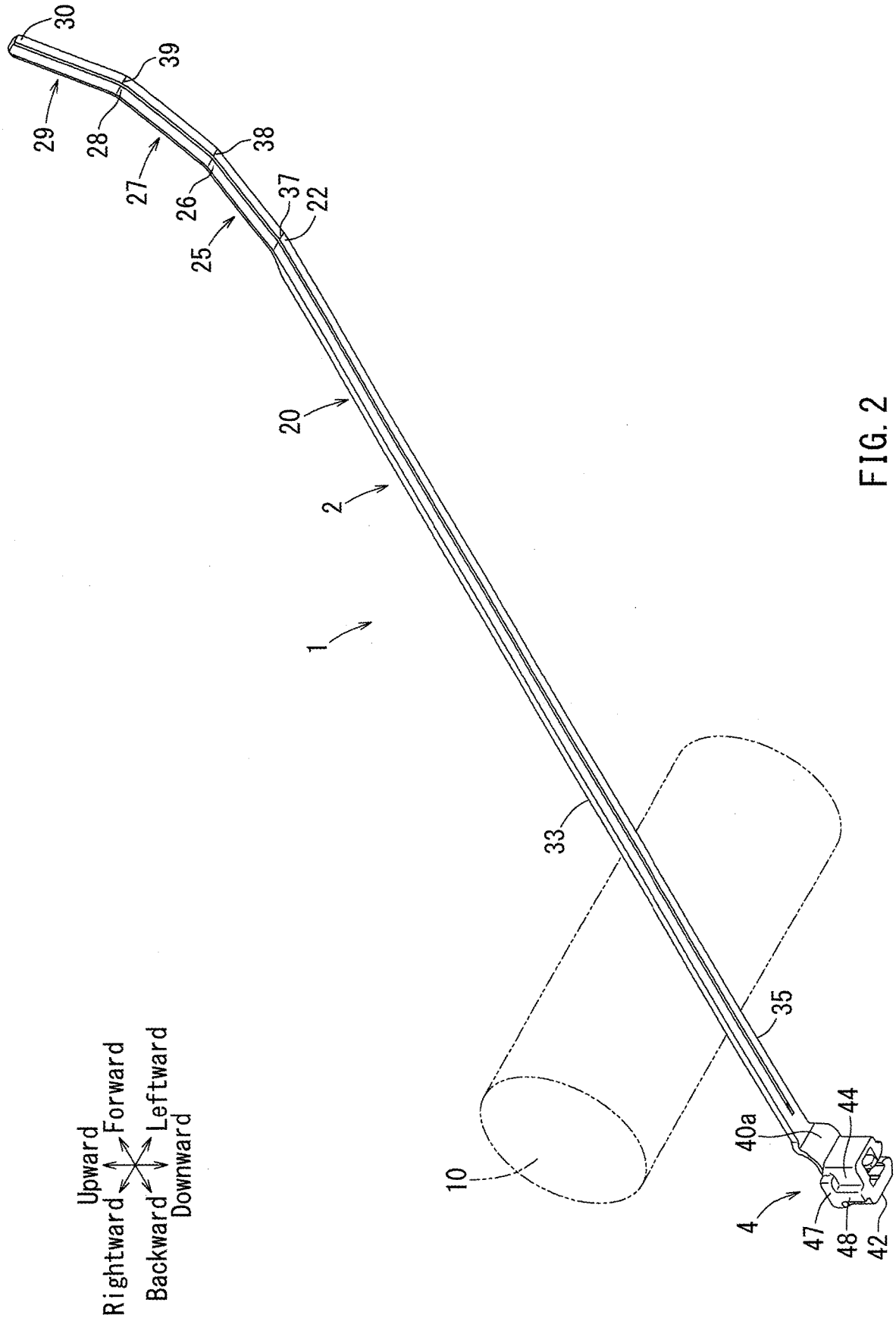
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FIG. 2

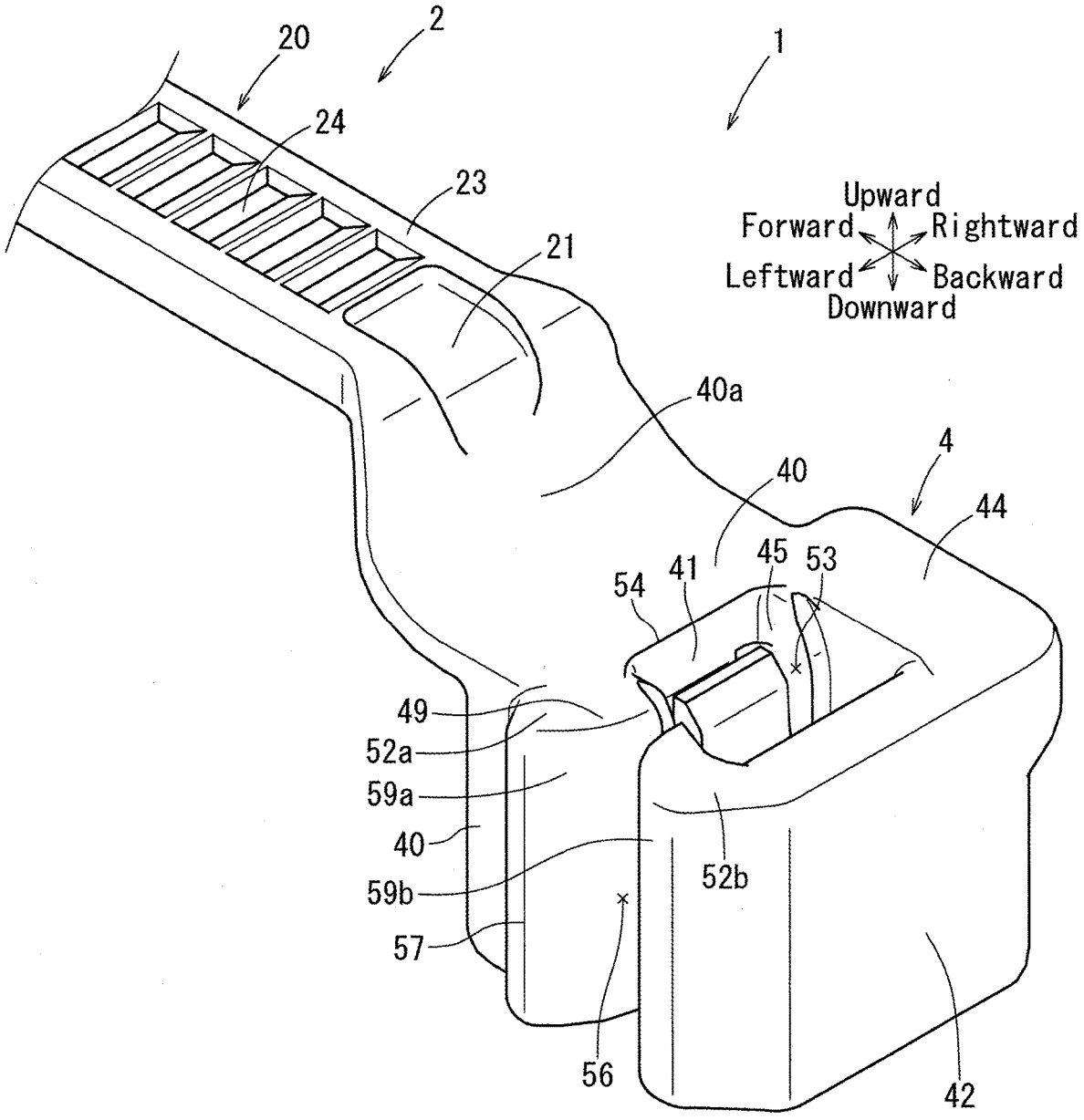
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FIG. 3

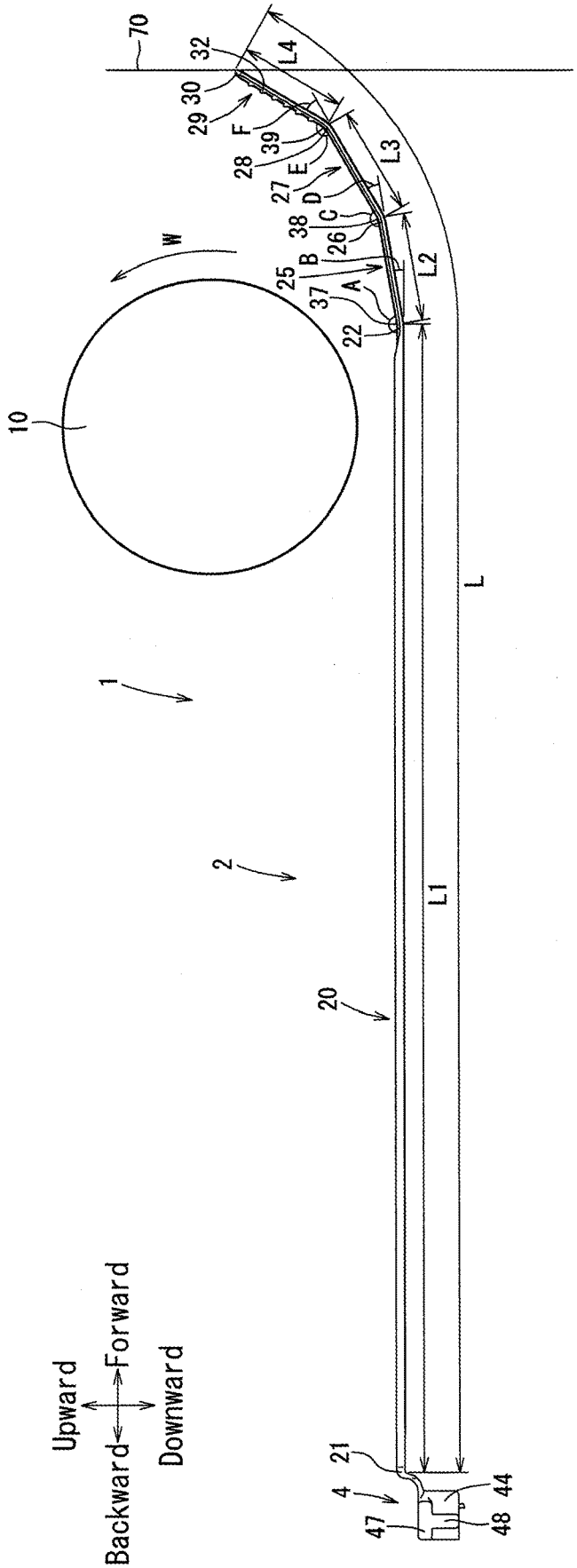
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FIG. 4

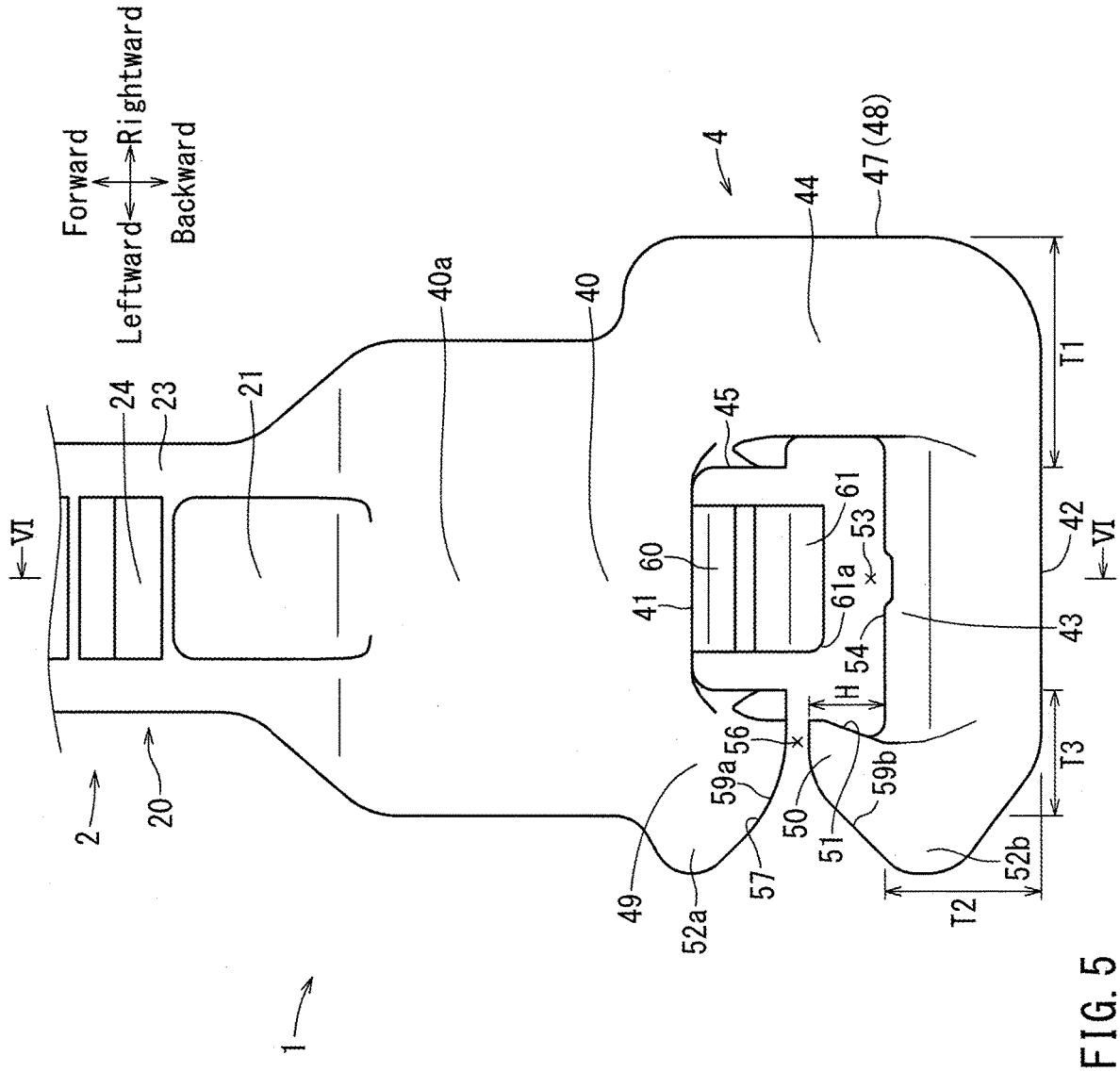
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FIG. 5

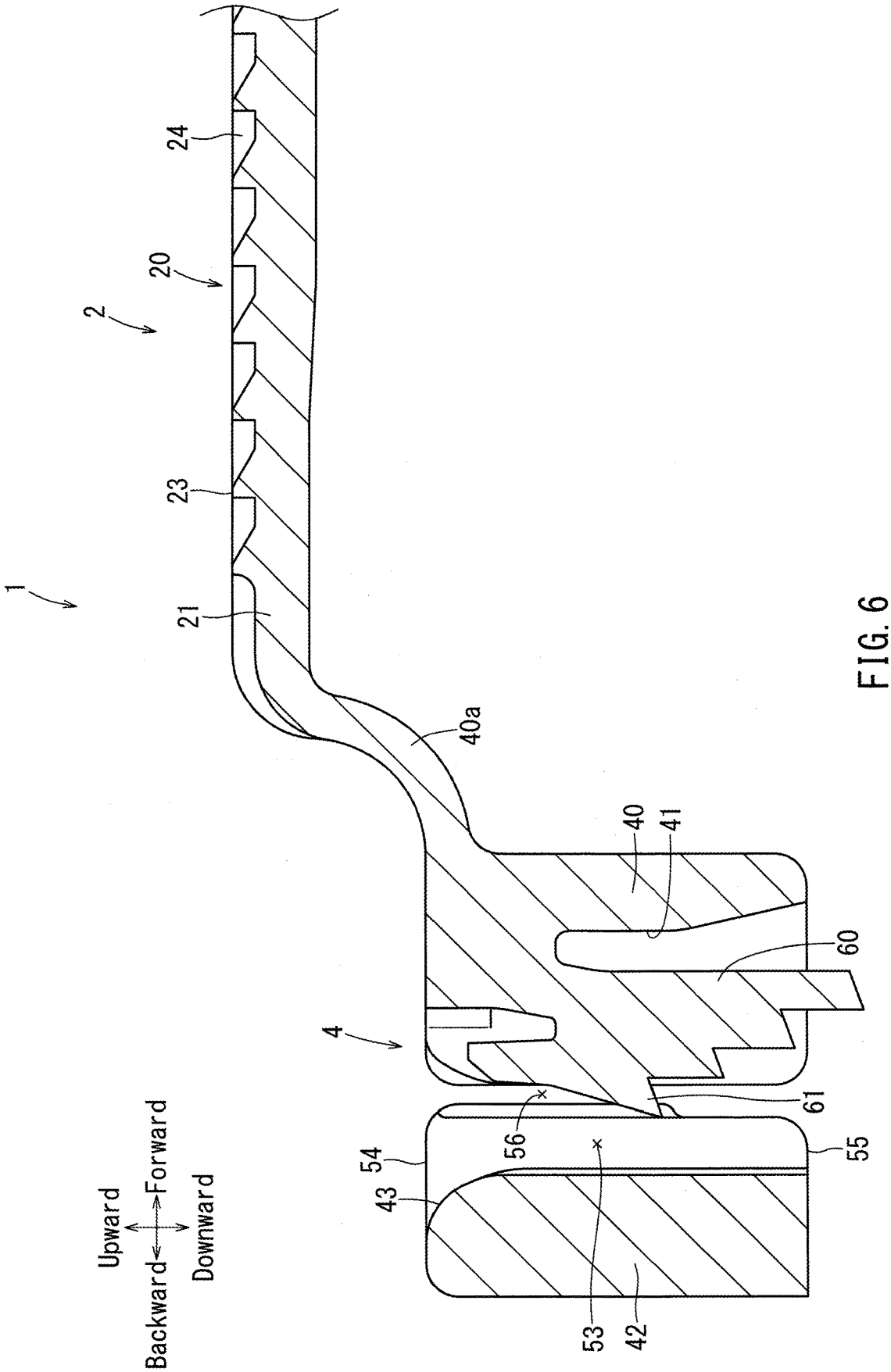
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FIG. 6

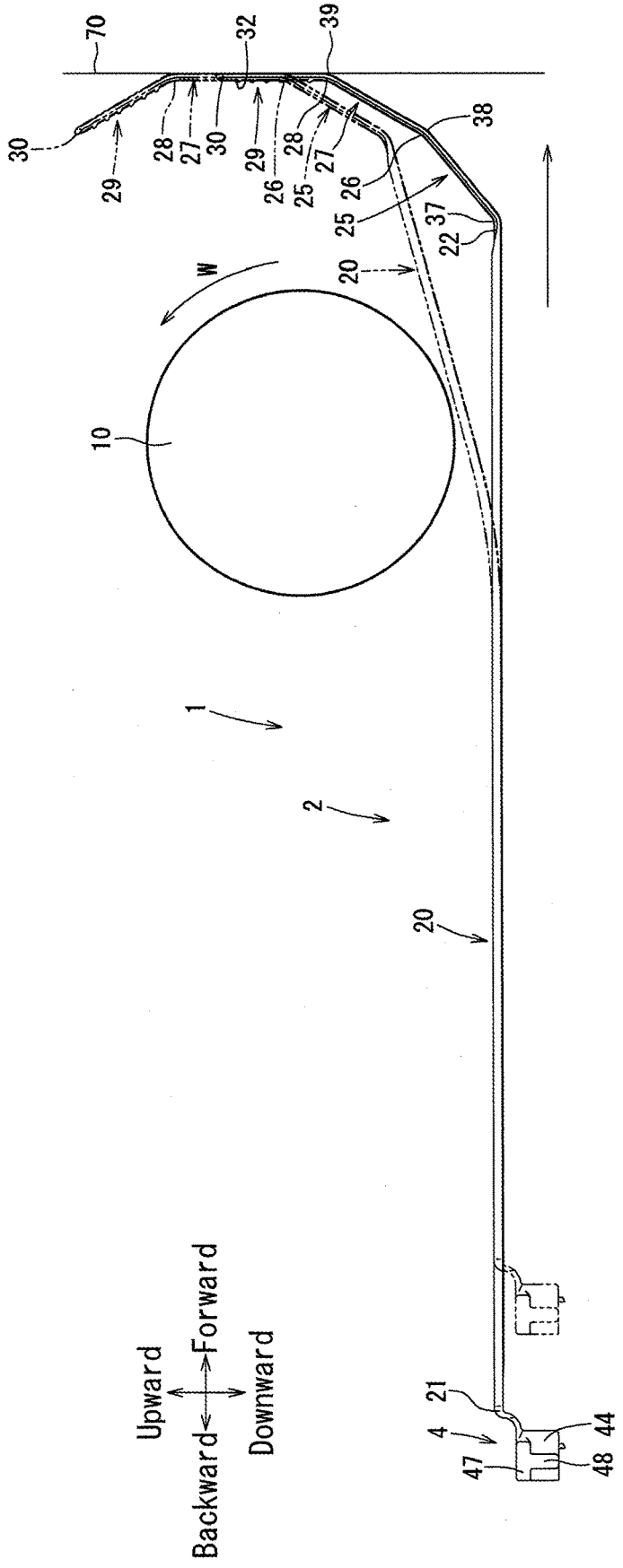
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FIG. 7

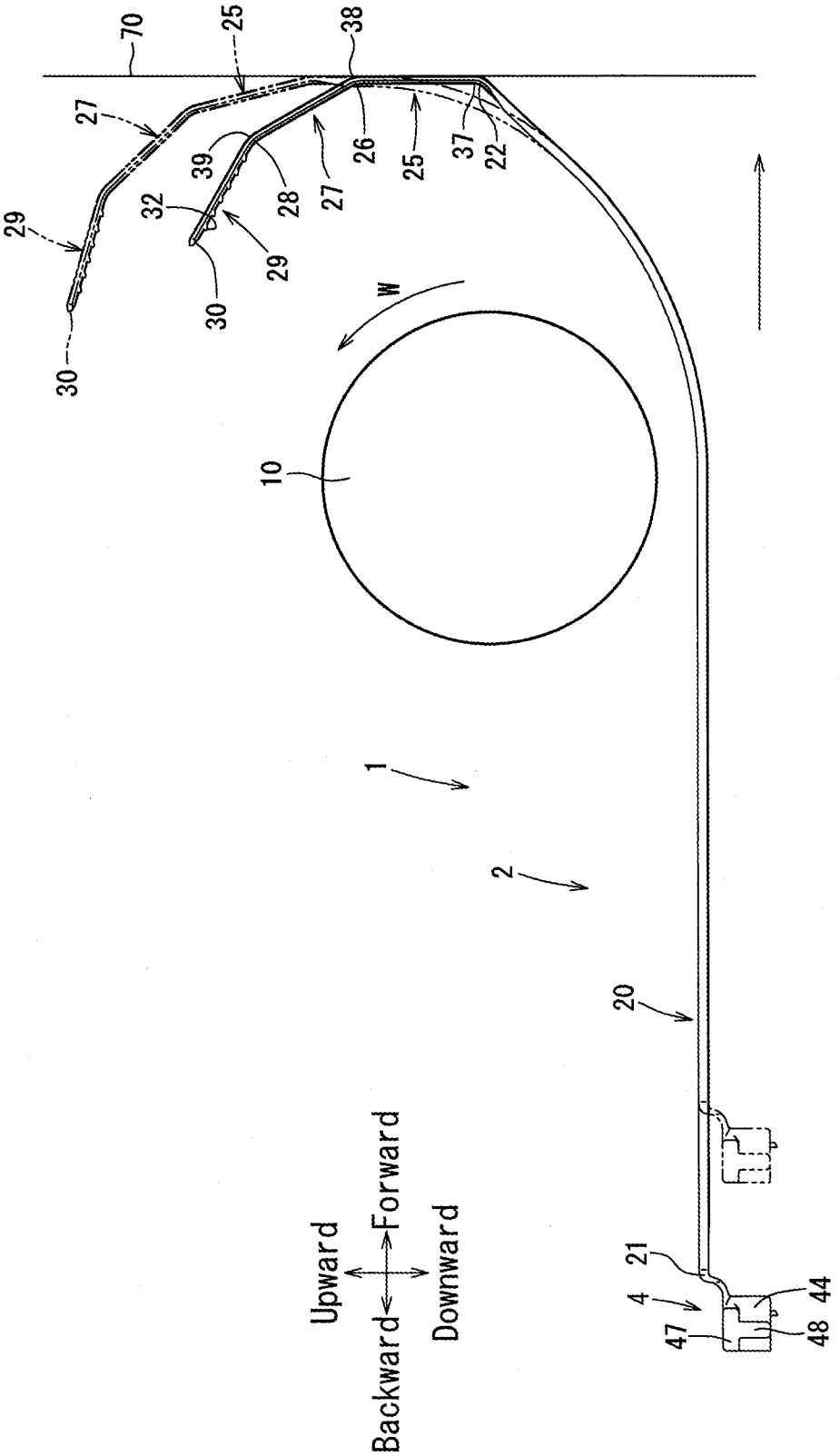
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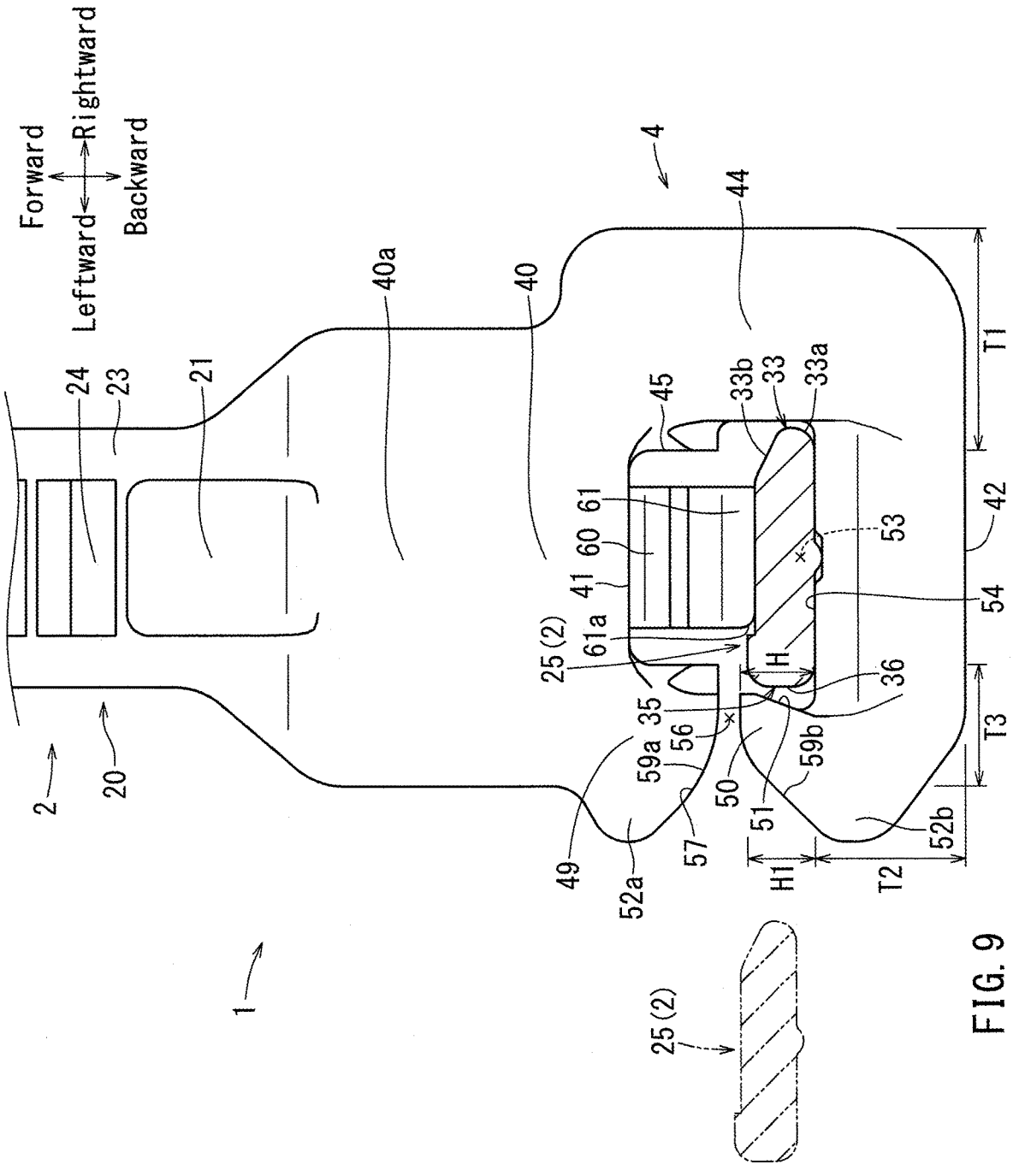
FIG. 8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42
54
25 (2)
61a
H
36
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FIG. 9

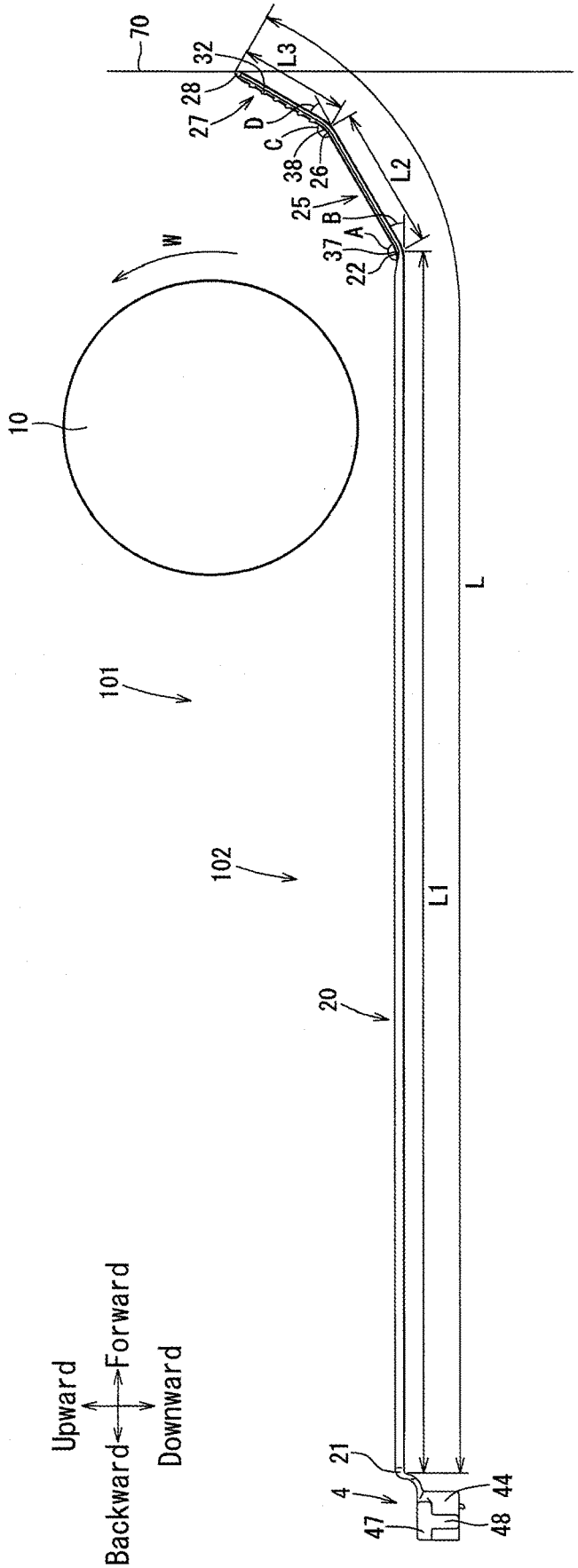
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FIG. 10

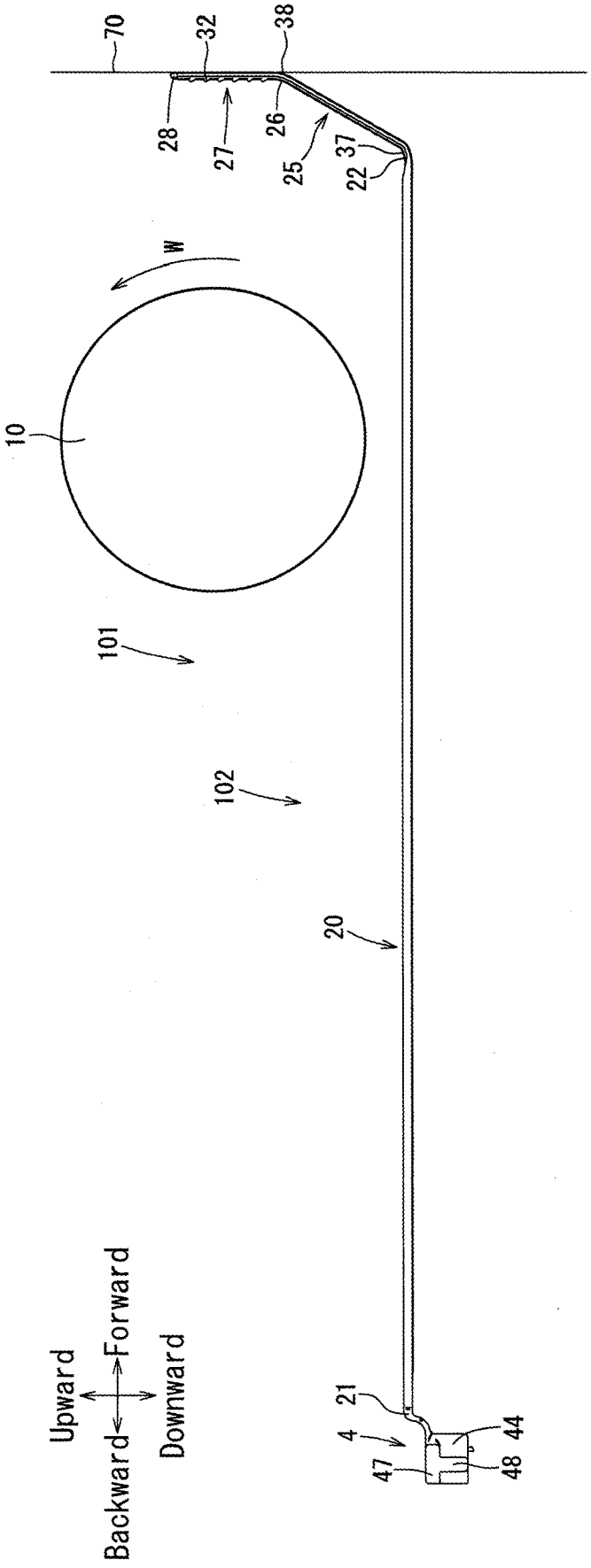
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FIG. 11

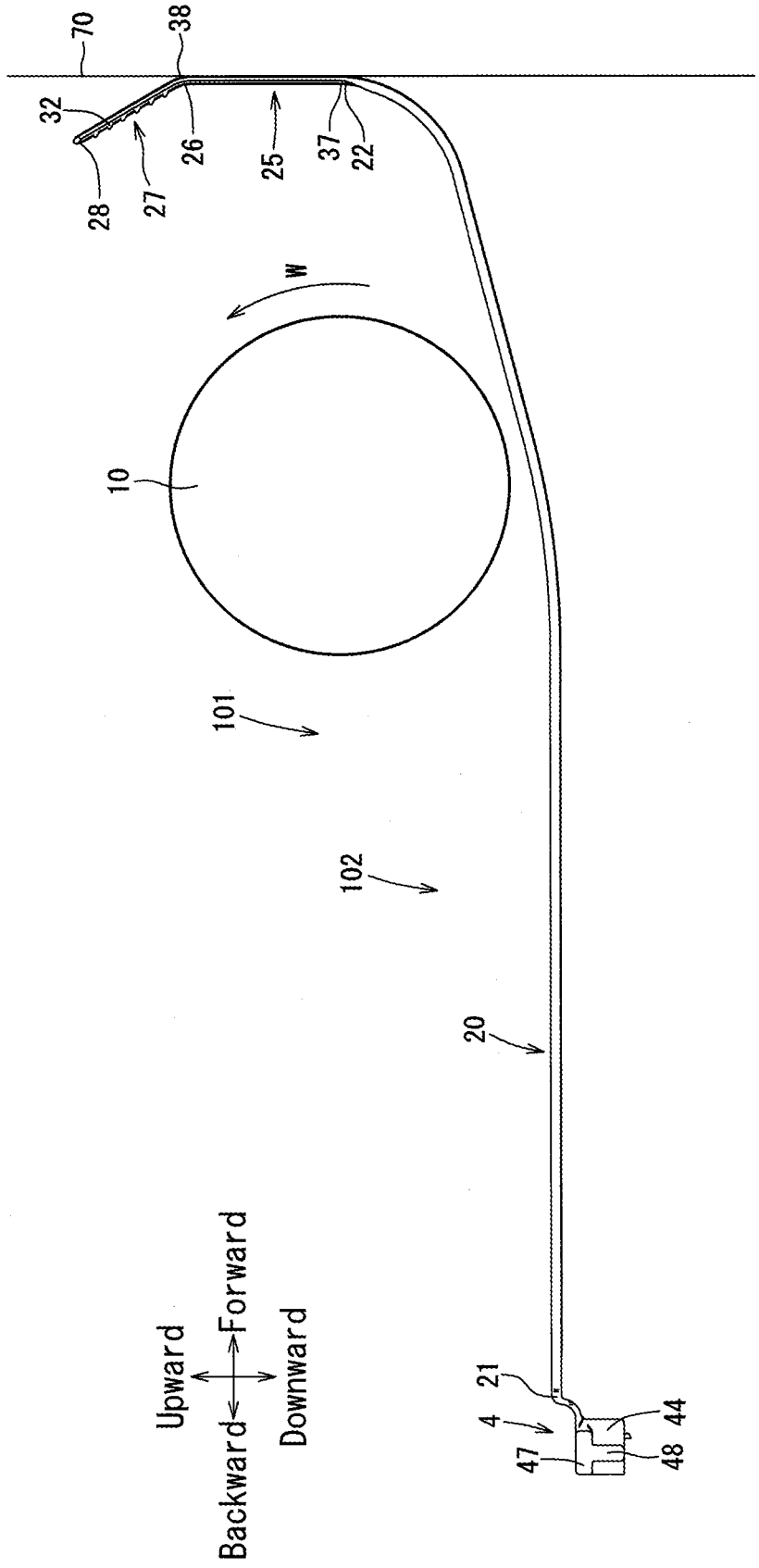
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FIG. 12

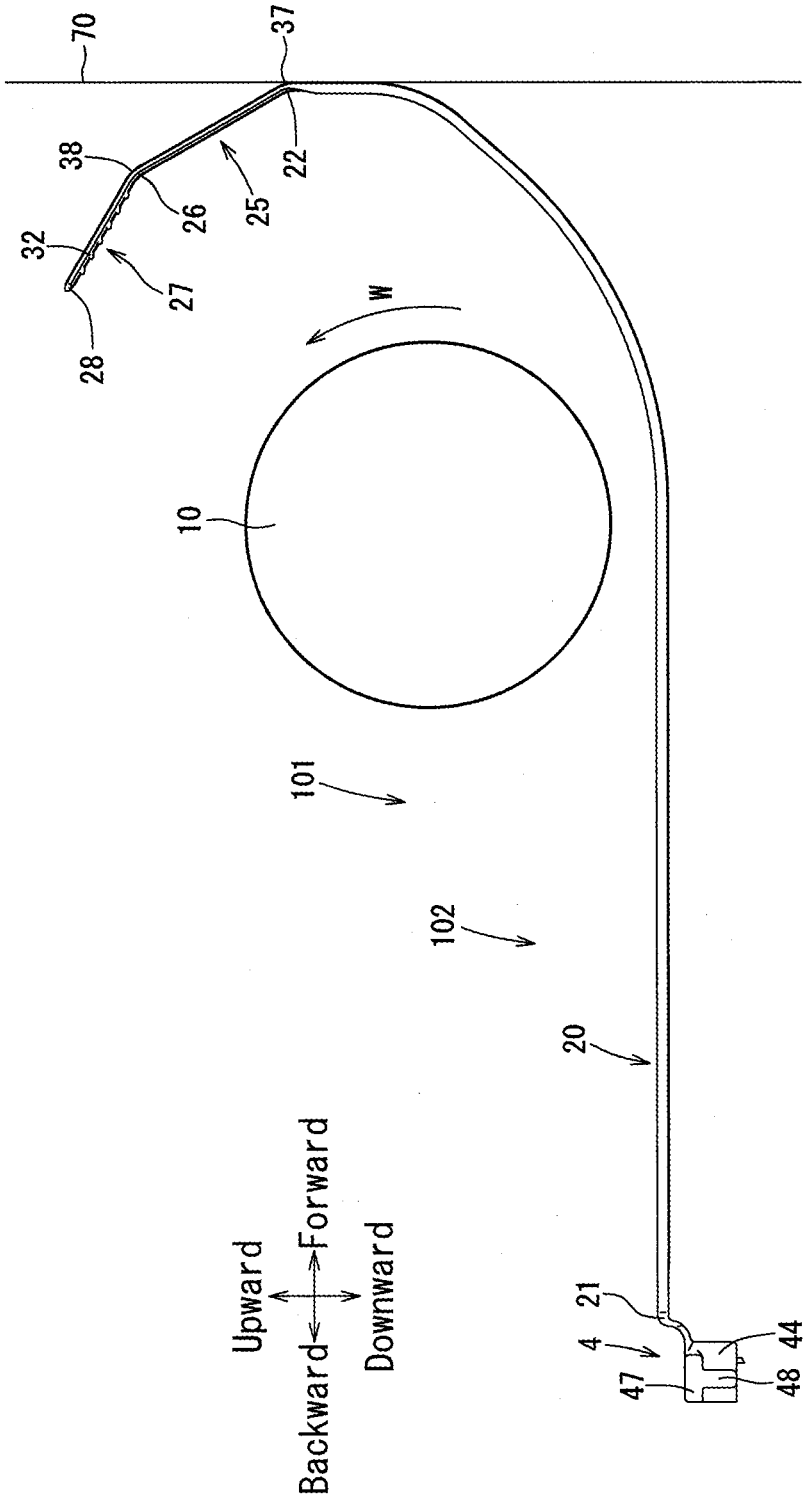
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FIG. 13

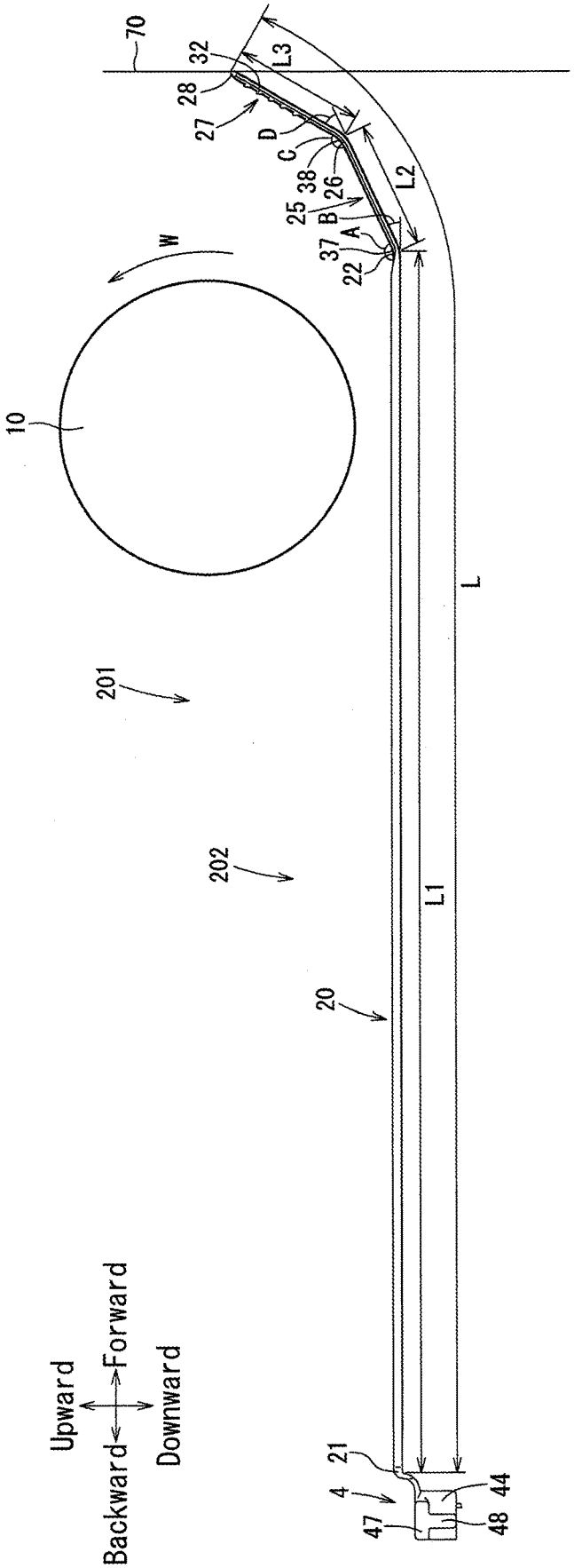
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FIG. 14

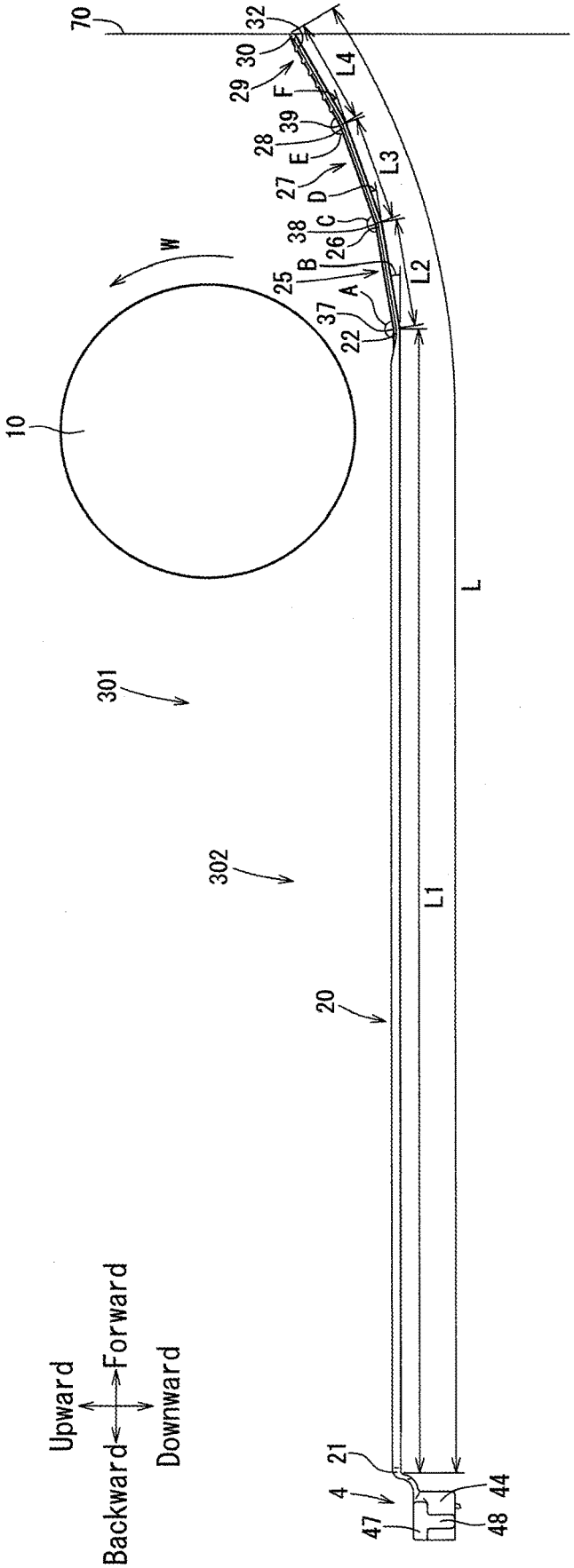
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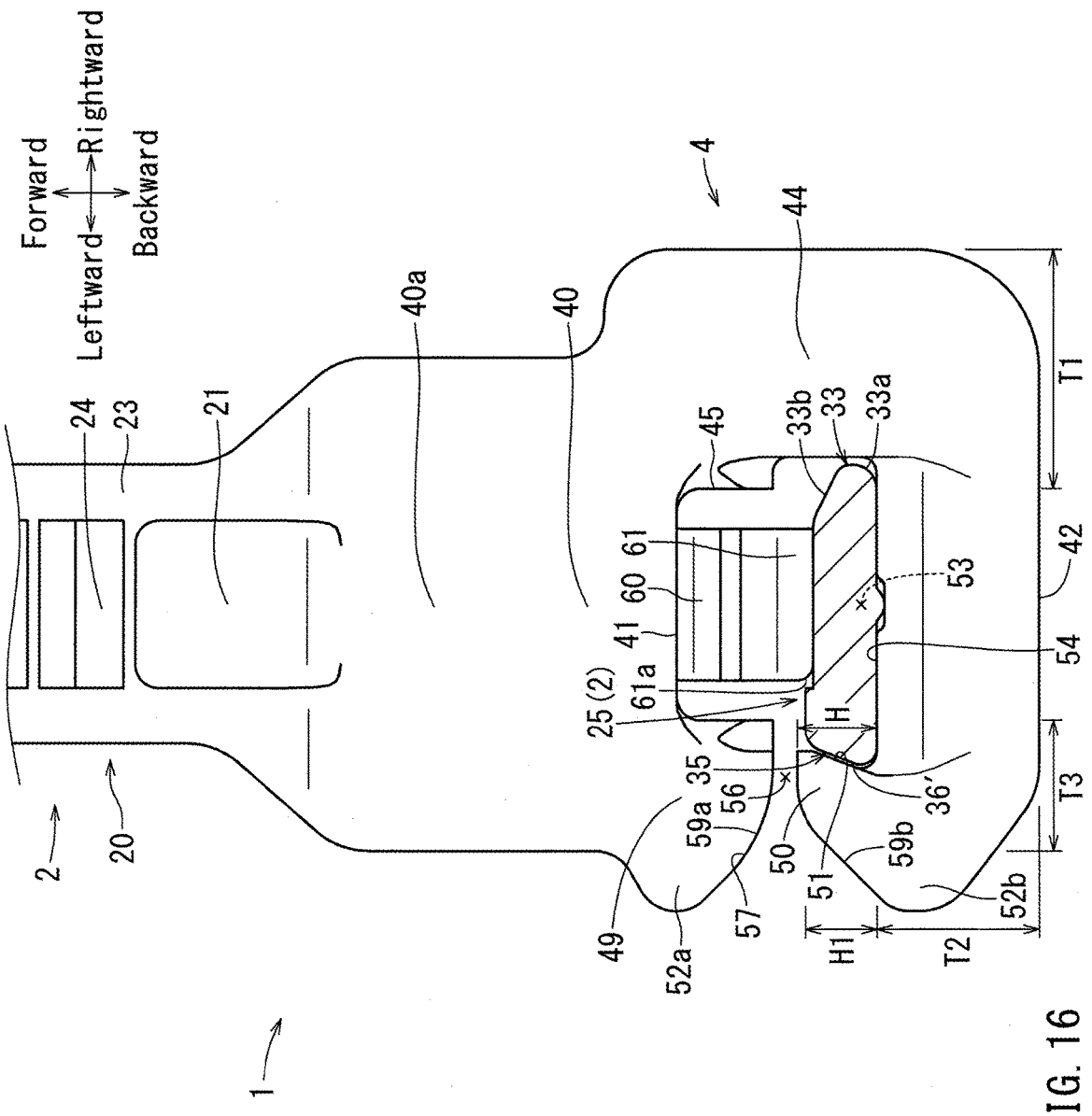
FIG. 15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61a
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T1
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FIG. 16

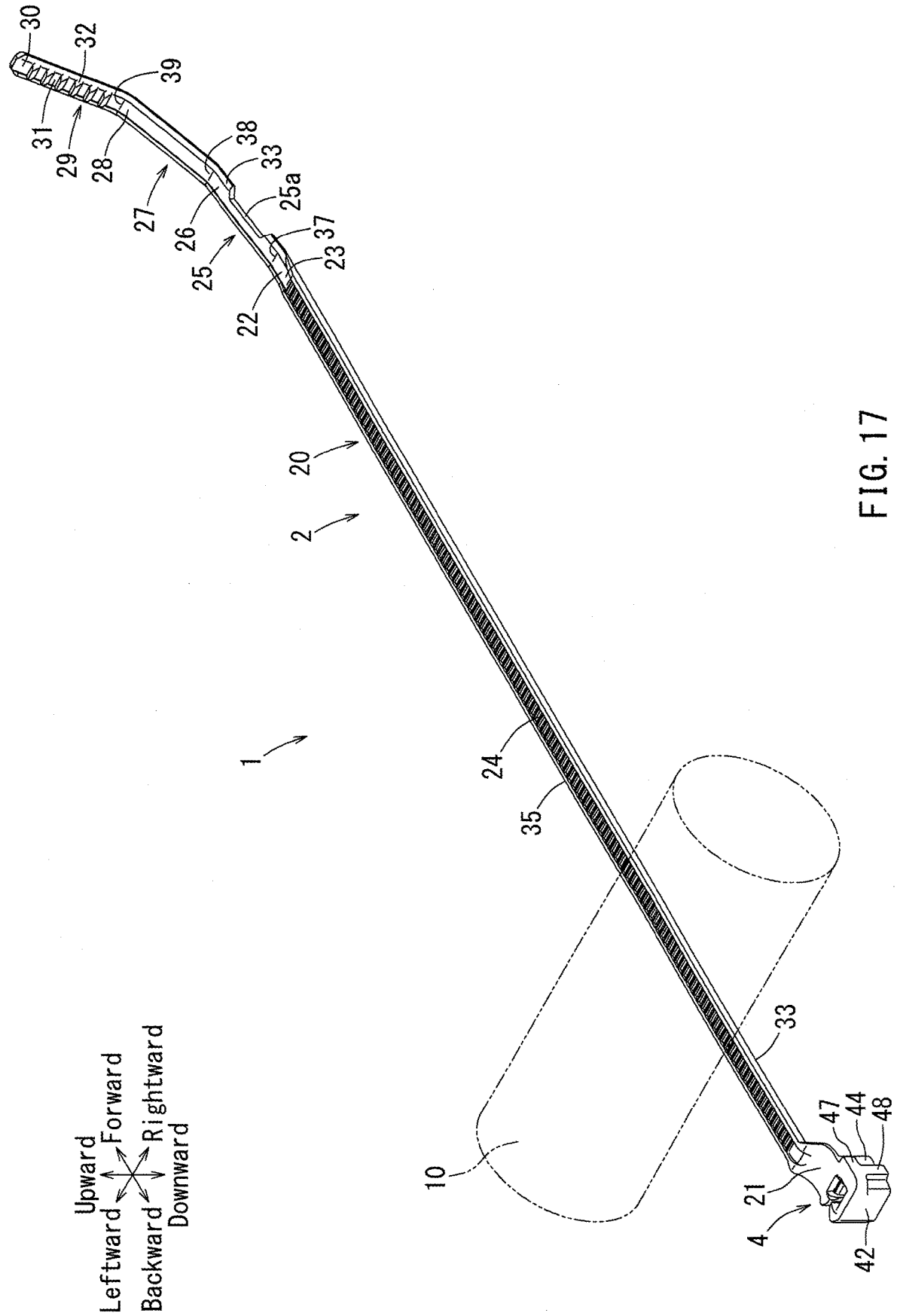
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FIG. 17

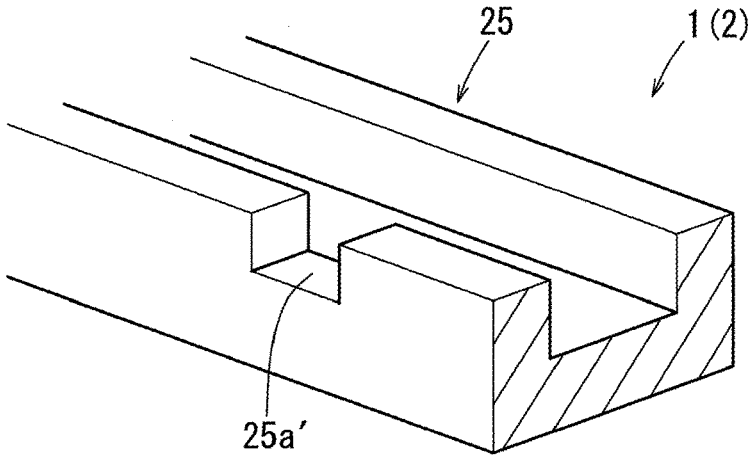

FIG. 18

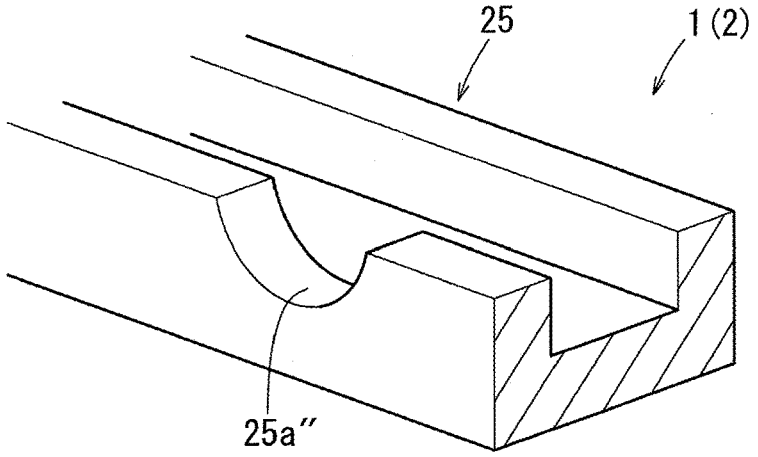

FIG. 19

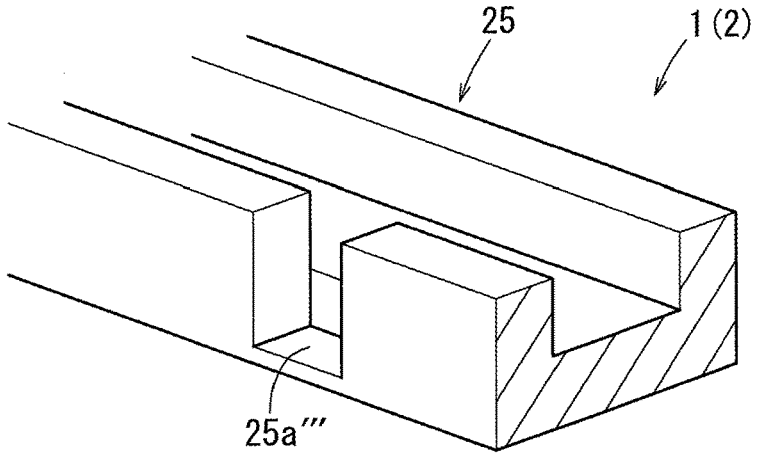

FIG. 20

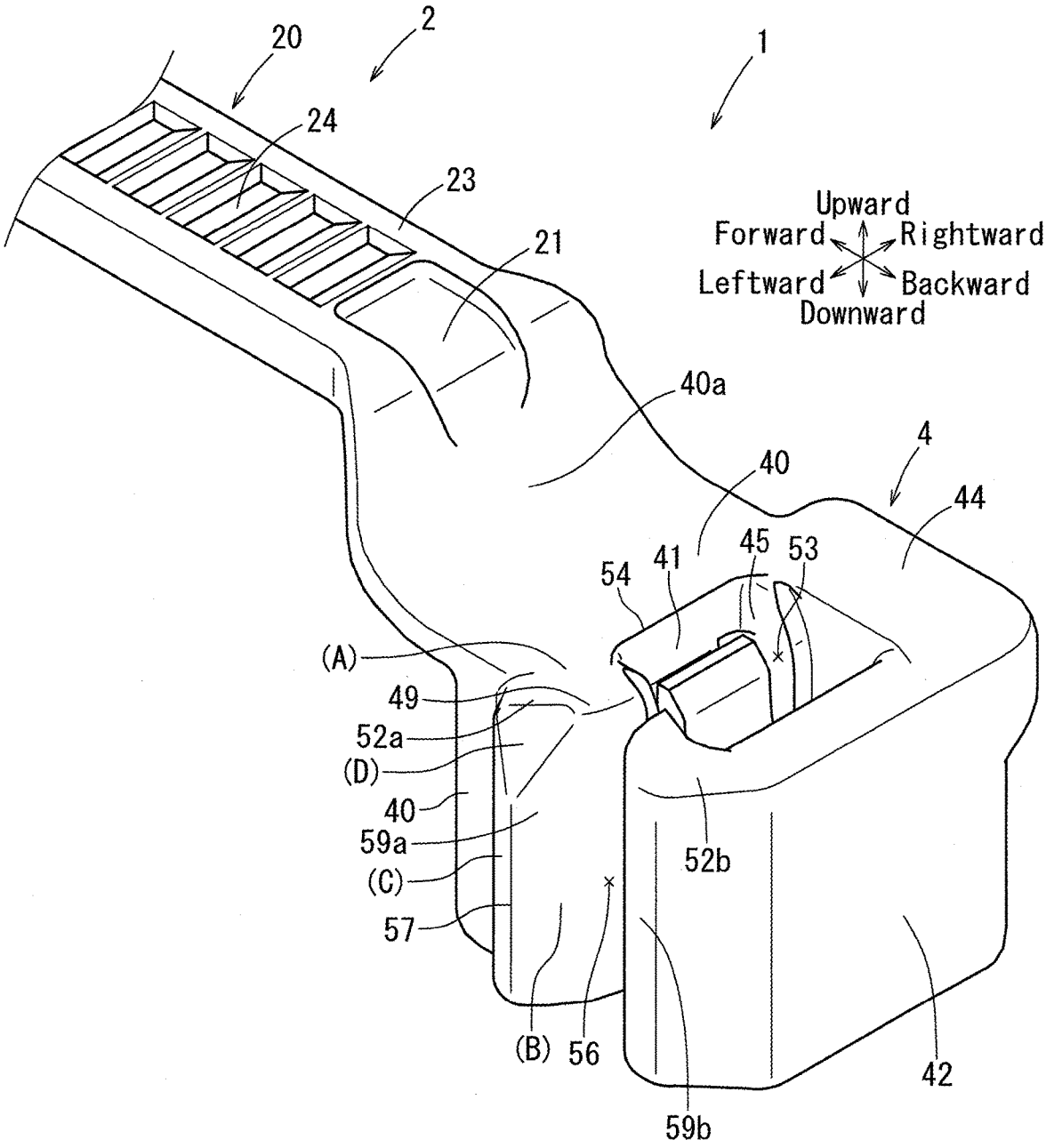
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FIG. 21

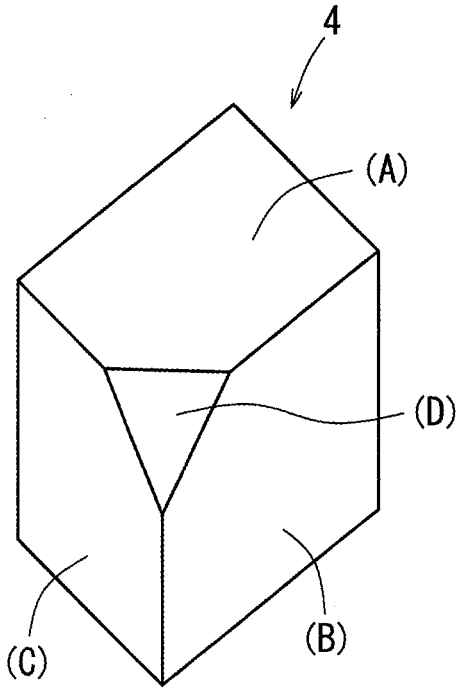

FIG. 22

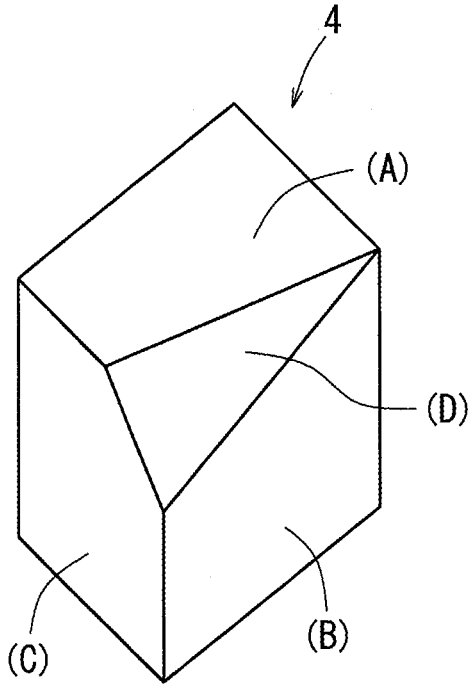

FIG. 23

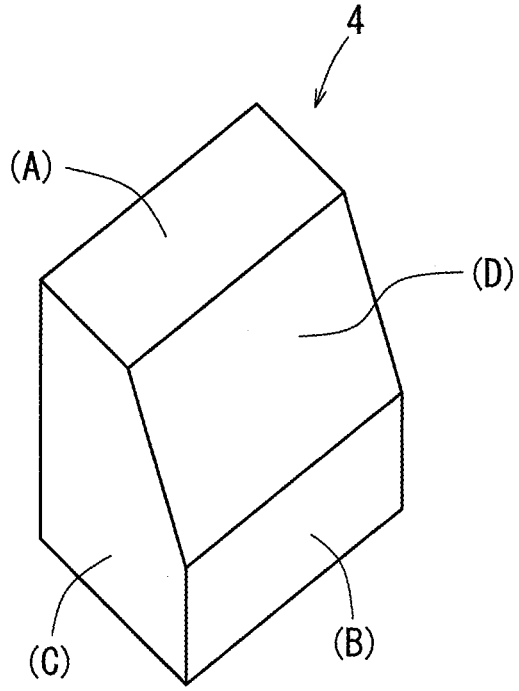

FIG. 24

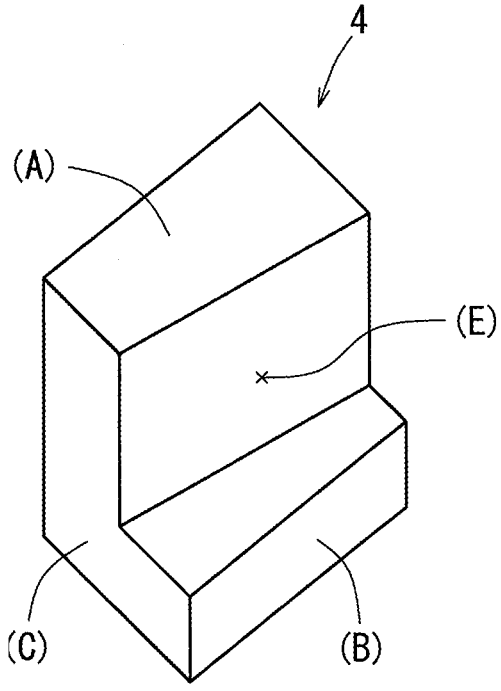

FIG. 25

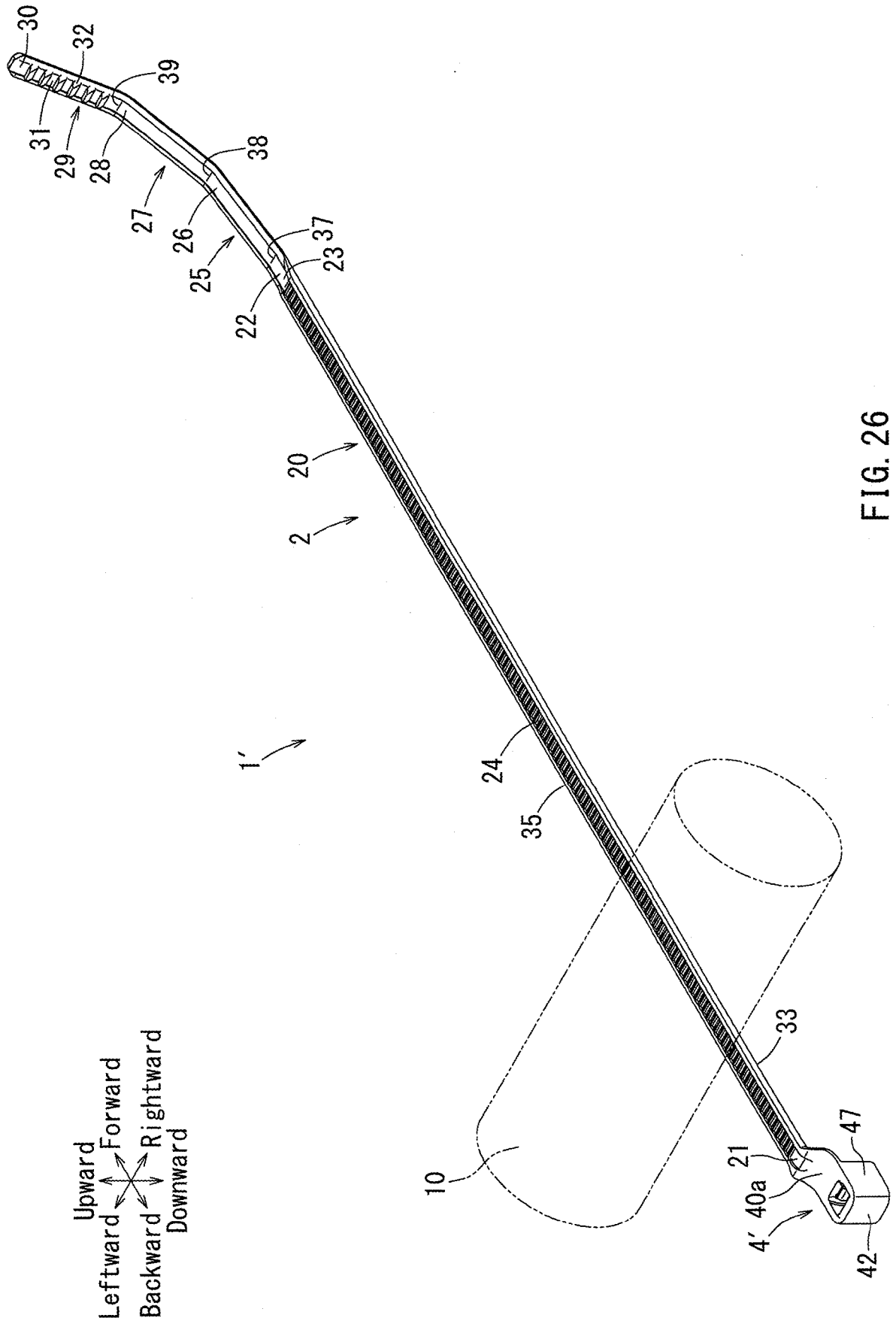
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FIG. 26

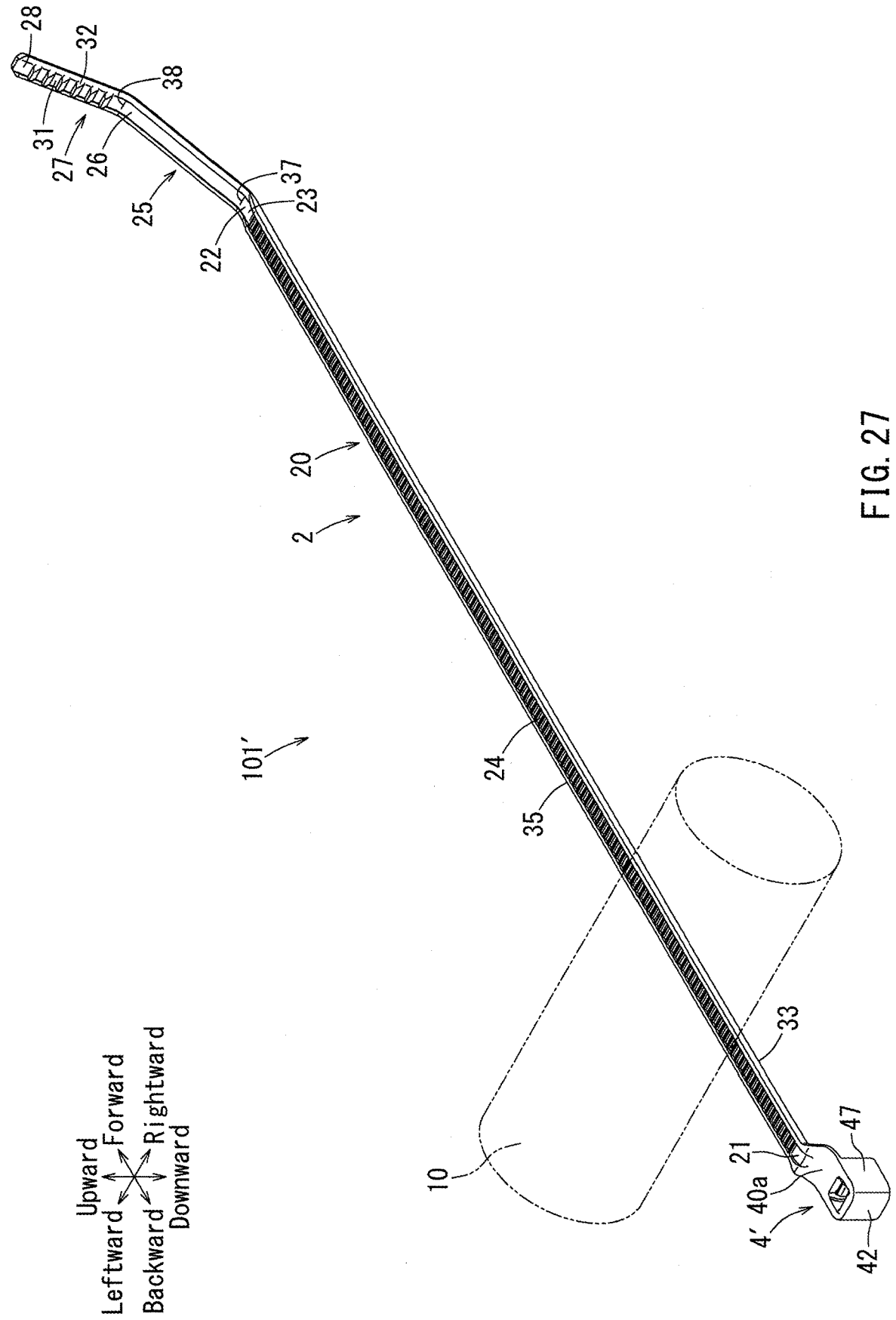
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FIG. 27

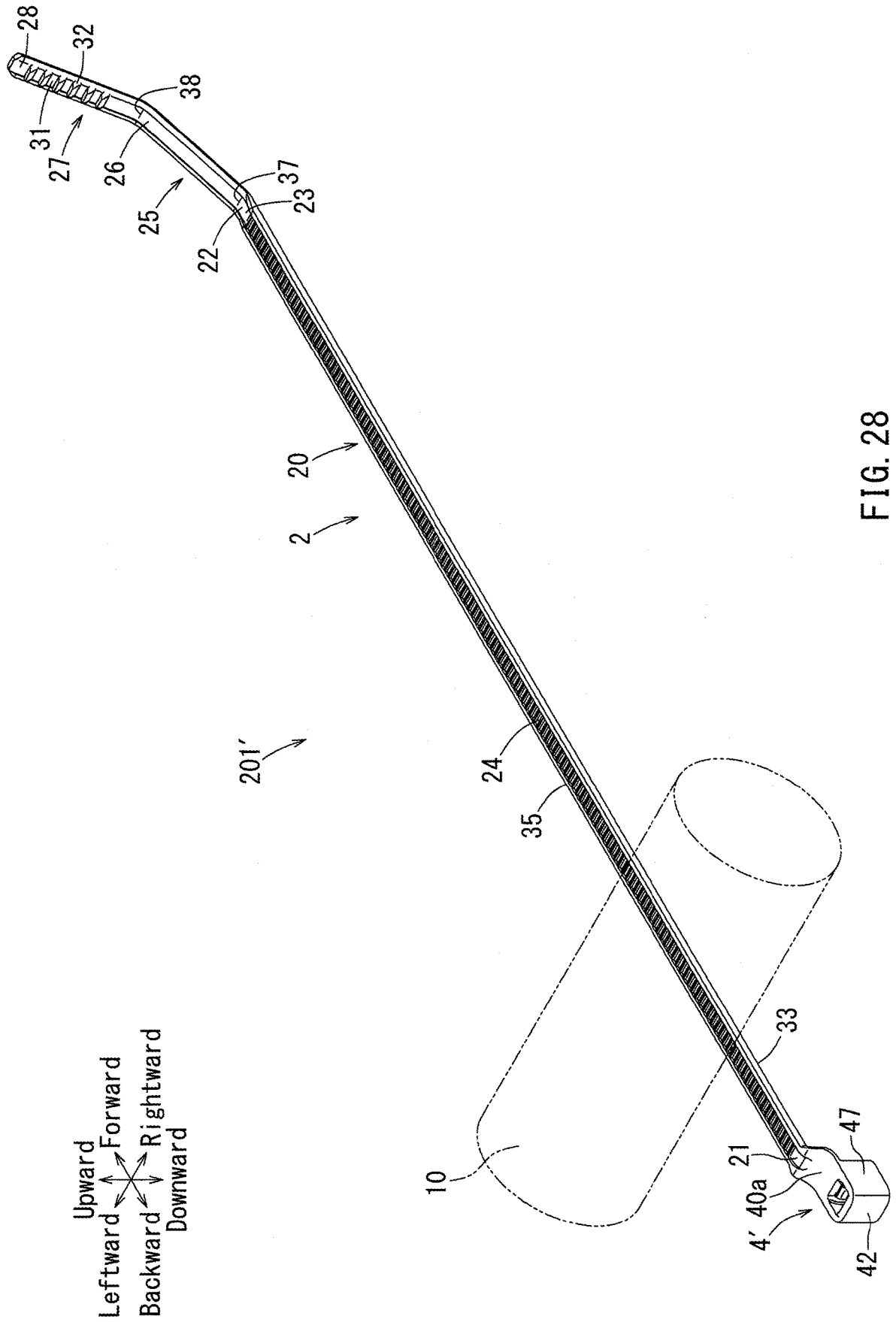
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FIG. 28

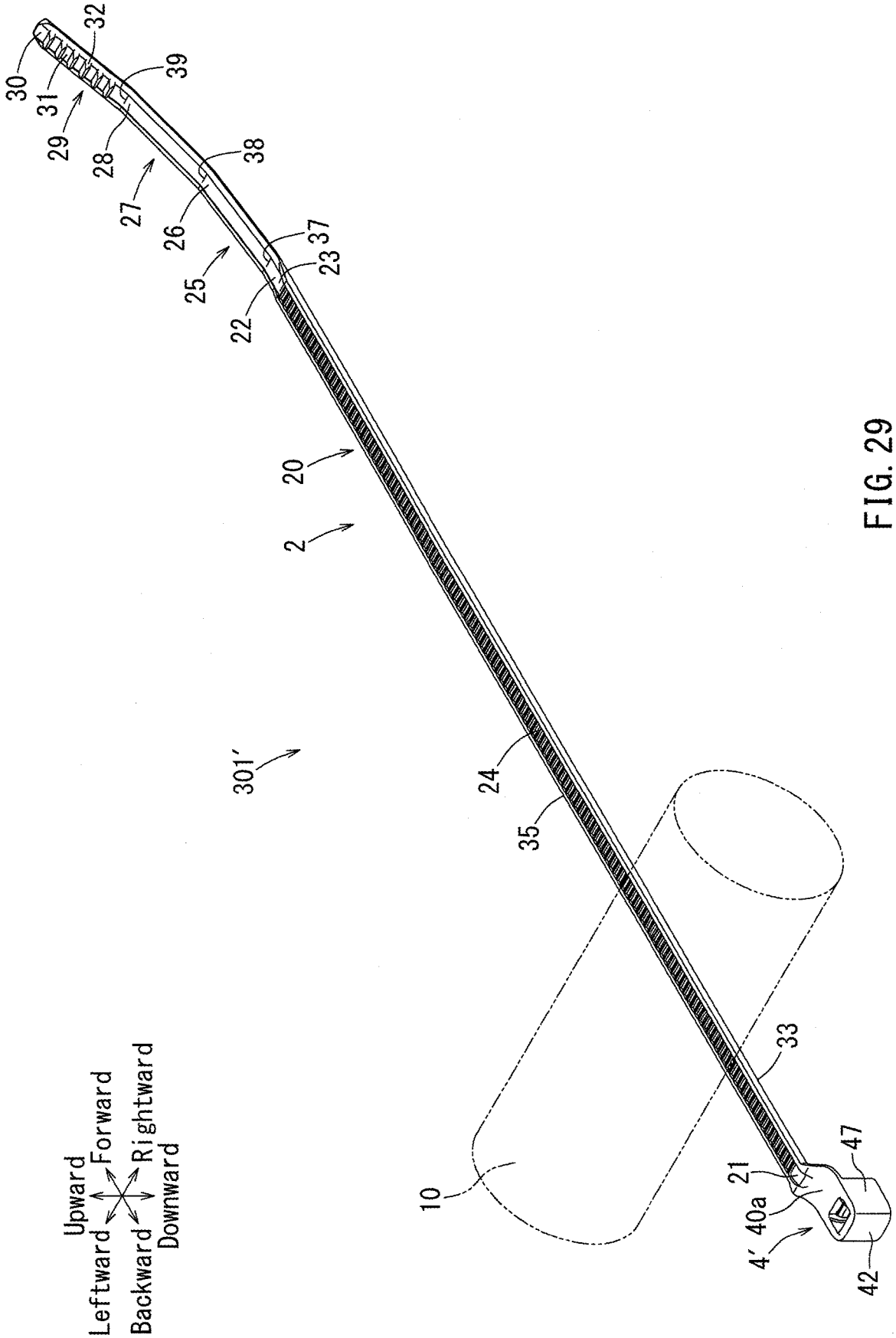
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FIG. 29

CABLE TIE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to Japanese Patent Application serial number 2022-120458 filed Jul. 28, 2022, the contents of which are incorporated herein by reference.

BACKGROUND

[0002] The present disclosure relates to a cable tie (a clamping band). More particularly, the present disclosure relates to a cable tie for tying together a bundle of tied articles (e.g., a wiring harness that is used for vehicle wiring).

[0003] Generally, a cable tie for tying together a bundle of tied articles (e.g., a wiring harness) includes a desired length of flexible belt that is configured to be wound or wrapped around the bundle of tied articles, and a buckle connected to a proximal end of the belt. In order to tie together the bundle of tied articles, the belt is wound or wrapped around the bundle of tied articles and is then inserted into a belt insertion hole formed in the buckle. Thereafter, the belt is fastened and is then locked by engaging an engagement strip formed in the belt insertion hole of the buckle. Thus, the bundle of tied articles is tied together by the cable tie.

[0004] A known cable tie is taught by, for example, Japanese Laid-Open Patent Publication No. 2012-116552. The known cable tie includes a buckle and a belt. The belt includes a first linear portion (a linear base portion) and a second linear portion (a linear leading portion) that are integrally formed. The first linear portion linearly extends from the buckle. The second linear portion linearly extends from a distal end of the first linear portion while being inclined at a desired angle with respect to the first linear portion in a direction which the belt is wrapped around a bundle of tied articles. According to the cable tie thus constructed, a worker can quickly tie together the bundle of the tied articles. In particular, the worker can easily pinch or hold the second linear portion of the belt applied to the bundle of tied articles by the fingers. Therefore, the worker can quickly wrap the belt around the bundle of tied articles by holding the second linear portion, thereby tying together the bundle of the tied articles by the belt.

[0005] Another known cable tie is taught by, for example, Japanese Laid-Open Utility Model Publication No. 61-119952. The known cable tie includes a buckle and a belt. The belt extends from the buckle while being curved in a direction which the belt is wrapped around a bundle of tied articles. According to the cable tie thus constructed, a worker can quickly tie together the bundle of the tied articles. In particular, the worker can easily pinch or hold a distal end of the belt applied to the bundle of the tied articles by the fingers due to a curvature of the belt. Therefore, the worker can quickly wrap the belt around the bundle of tied articles by holding the distal end of the belt, thereby tying together the bundle of the tied articles by the belt.

[0006] However, the bundle of tied articles for tying together is sometimes positioned adjacent to a wall-like structural member (e.g., a vehicle body panel). In such a case, in the known cable tie taught by Japanese Laid-Open Patent Publication No. 2012-116552, the worker cannot easily hold the second linear portion of the belt applied to the bundle of tied articles by the fingers because the structural member becomes obstructive. As a result, the worker cannot easily wrap the belt around the bundle of tied articles. Therefore, in order to hold the second linear portion of the belt by the fingers, the worker pushes the belt toward the structural member with the intention to move or slide the second linear portion along the structural member. However, when the belt is thrusted toward the structural member, the second linear portion may be pressed to the structural member, so as to be orthogonally flexed relative to the first linear portion while contacting the structural member over the entire length thereof. As a result, the second linear portion may be prevented from moving along the structural member. Therefore, that the worker cannot easily hold the second linear portion by the fingers even when the belt is thrusted toward the structural member. Similarly, in the known cable tie taught by Japanese Laid-Open Utility Model Publication No. 61-119952, the worker cannot easily hold the distal end of the belt by the fingers because the structural member becomes obstructive. As a result, the worker cannot easily wrap the belt around the bundle of tied articles. Further, when the belt is thrusted toward the structural member, the belt may be flexed in whole by contacting the structural member. As a result, the distal end of the belt may be prevented from moving along the structural member. Therefore, the worker cannot easily hold the second linear portion by the fingers even when the belt is thrusted toward the structural member. Thus, according to the known cable ties, the worker cannot quickly wrap the belt around the bundle of tied articles in the case in which the bundle of tied articles is positioned adjacent to the structural member.

[0007] Thus, there is a need in the art for improved cable ties.

SUMMARY

[0008] For example, in one aspect of the present disclosure, a cable tie may include a desired length of belt configured to be wrapped around a bundle of tied articles, and a buckle connected to a proximal end portion of the belt and having a belt insertion hole into which the belt is introduced. The belt includes a base portion linearly extending from the buckle and a functional portion having a first linear portion and a second linear portion. The first linear portion is connected to a distal end of the base portion at a proximal end thereof. The second linear portion is connected to a distal end of the first liner portion at a proximal end thereof. The first linear portion is inclined at a first angle with respect to the base portion in a belt wrapping direction. The second linear portion is inclined at a second angle with respect to the first liner portion in the belt wrapping direction. The first angle is determined to be equal to or smaller than the second angle.

[0009] According to this aspect, even in a case where a bundle of tied articles is positioned adjacent to a wall-like obstacle, a worker can easily wrap the belt around the bundle of tied articles by holding a distal end portion of the belt in order to tie together the bundle of tied articles. In particular, in order to wrap the belt around the bundle of tied articles in such a case, the belt is positioned under the bundle of tied articles with a distal end of the second linear portion of the functional portion contacting the obstacle. In this condition, when the belt is pressed to the obstacle, the second linear portion and the first linear portion may be pressed against and spaced away from the obstacle in a stepwise fashion while moving along the obstacle. As a result, the second

linear portion and the first linear portion of the functional portion may be continuously extend toward the buckle from the obstacle in this order. That is, the second linear portion and the first linear portion may extend in the belt wrapping direction around the bundle of the tied articles in this order. Therefore, the worker can easily hold the distal end portion of the belt even in the case where the bundle of tied articles is positioned adjacent to the obstacle.

[0010] Additional objects, features and advantages of the present disclosure will be readily understood after reading the following detailed description together with the accompanying drawings and the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. **1** is an overall perspective view of a cable tie according to a first representative embodiment of the present disclosure, which is viewed from above;

[0012] FIG. **2** is an overall perspective view of the cable tie, which is viewed from the bottom;

[0013] FIG. **3** is an enlarged perspective view of a buckle of the cable tie, which is viewed from above;

[0014] FIG. **4** is a side view of the cable tie, which is viewed from the right;

[0015] FIG. **5** is a plan view of FIG. **3**;

[0016] FIG. **6** is a cross-sectional view taken along line VI-VI in FIG. **5**;

[0017] FIG. **7** is a side view of the cable tie, which illustrates a process of tying together a bundle of tied articles using the cable tie;

[0018] FIG. **8** is a side view of the cable tie, which illustrates the process of tying together the bundle of tied articles using the cable tie;

[0019] FIG. **9** is an enlarged partially cross-sectional plan view of the buckle into which a belt of the cable tie is introduced, which illustrates the process of tying together the bundle of tied articles using the cable tie;

[0020] FIG. **10** is a side view of a cable tie according to a second representative embodiment of the present disclosure, which is viewed from the right;

[0021] FIG. **11** is a side view of the cable tie, which illustrates a process of tying together a bundle of tied articles using the cable tie;

[0022] FIG. **12** is a side view of the cable tie, which illustrates the process of tying together the bundle of tied articles using the cable tie;

[0023] FIG. **13** is a side view of the cable tie, which illustrates the process of tying together the bundle of tied articles using the cable tie;

[0024] FIG. **14** is a side view of a cable tie according to a third representative embodiment of the present disclosure, which is viewed from the right;

[0025] FIG. **15** is a side view of a cable tie according to a fourth representative embodiment of the present disclosure, which is viewed from the right;

[0026] FIG. **16** is a view similar to FIG. **9**, which illustrates a belt of a cable tie according to a first modified embodiment of the first embodiment;

[0027] FIG. **17** is an overall perspective view of a cable tie according to a second modified embodiment of the first embodiment, which is viewed from above;

[0028] FIG. **18** is a schematic partial perspective view of the belt of the cable tie according to the second modified embodiment, which shows a modified form of a removed portion formed in the belt;

[0029] FIG. **19** is a schematic partial perspective view of the belt of the cable tie according to the second modified embodiment, which shows a modified form of the removed portion formed in the belt;

[0030] FIG. **20** is a schematic partial perspective view of the belt of the cable tie according to the second modified embodiment, which shows a modified form of the removed portion formed in the belt;

[0031] FIG. **21** is a view similar to FIG. **3**, which illustrates a buckle of a cable tie according to a third modified embodiment of the first embodiment,

[0032] FIG. **22** is a schematic partial perspective view of the buckle of the cable tie according to the third modified embodiment, which schematically shows a form of an inclined surface formed on the buckle;

[0033] FIG. **23** is a schematic partial perspective view of the buckle of the cable tie according to the third modified embodiment, which schematically shows a modified form of the inclined surface formed on the buckle;

[0034] FIG. **24** is a schematic partial perspective view of the buckle of the cable tie according to the third modified embodiment, which schematically shows a modified form of the inclined surface formed on the buckle;

[0035] FIG. **25** is a schematic partial perspective view of the buckle of the cable tie according to the third modified embodiment, which schematically shows a modified form of the inclined surface formed on the buckle;

[0036] FIG. **26** is an overall perspective view of a cable tie according to a fifth representative embodiment of the present disclosure, which is viewed from above;

[0037] FIG. **27** is an overall perspective view of a cable tie according to a sixth representative embodiment of the present disclosure, which is viewed from above;

[0038] FIG. **28** is an overall perspective view of a cable tie according to a seventh representative embodiment of the present disclosure, which is viewed from above; and

[0039] FIG. **29** is an overall perspective view of a cable tie according to an eighth representative embodiment of the present disclosure, which is viewed from above.

DETAILED DESCRIPTION

[0040] Detailed representative embodiments of the present disclosure are shown in FIGS. **1** to **29**.

[0041] A first detailed representative embodiment of the present disclosure will be described with reference to FIGS. **1** to **9**. The first embodiment may be directed to a cable tie **1** for tying together a bundle of tied articles. Further, in this embodiment, a wiring harness **10** that is used for vehicle wiring may be shown as an example of the bundle of tied article. Further, a longitudinal or front-back direction (forward and backward directions), a lateral direction (rightward and leftward directions) and a vertical direction (upward and downward directions) described therein are determined only for the purpose of convenience and not intended to limit the disclosure.

[0042] As shown in FIGS. **1**, **2** and **4**, the cable tie **1** may be integrally formed as a unit by integral molding of a rigid synthetic resin. The cable tie **1** may include a desired length of flexible belt **2** and a buckle **4**. The belt **2** may have a substantially constant width over the entire length thereof and may be configured to be wrapped around the wiring harness **10**. The belt **2** may have a base portion **20** and a functional portion (not labeled). The base portion **20** of the belt **2** may be connected to the buckle **4** (which will be

hereinafter described) at a proximal end **21** thereof. The base portion **20** may substantially horizontally linearly extend forward from the buckle **4**. Further, the proximal end **21** of the base portion **20** may be referred to as a proximal end portion of the belt **2**.

[0043] As shown in FIGS. **1**, **2** and **4**, the functional portion of the belt **2** may include a first linear portion **25**, a second linear portion **27** and a third linear portion **29**. The first linear portion may be connected to a distal end **22** of the base portion **20** at a proximal end (not labeled) thereof. Further, as shown in FIG. **4**, the first linear portion **25** may be inclined at an (first) angle B with respect to the base portion **20** in a direction which the belt **2** is wrapped around the wiring harness **10**. Further, such a direction may be hereinafter referred to as a belt wrapping direction W. In other words, the first linear portion **25** may be inclined with respect to the base portion **20** in the belt wrapping direction W so as to form an angle A (which may be referred to as a supplementary angle of the angle B) therebetween. Thus, the first liner portion **25** may be inwardly obliquely connected to the base portion **20** via a bent portion **37**.

[0044] As shown in FIGS. **1**, **2** and **4**, the second linear portion **27** may be connected to a distal end **26** of the first liner portion **25** at a proximal end (not labeled) thereof. Further, as shown in FIG. **4**, the second linear portion **27** may be inclined at an (second) angle D with respect to the first liner portion **25** in the belt wrapping direction W. In other words, the second linear portion **27** may be inclined with respect to the first linear portion **25** in the belt wrapping direction W so as to form an angle C (which may be referred to as a supplementary angle of the angle D) therebetween. Thus, the second liner portion **27** may be inwardly obliquely connected to the first linear portion **25** via a bent portion **38**.

[0045] As shown in FIGS. **1**, **2** and **4**, the third linear portion **29** may be connected to a distal end **28** of the second liner portion **27** at a proximal end (not labeled) thereof. Further, as shown in FIG. **4**, the third linear portion **29** may be inclined at an (third) angle F with respect to the second liner portion **27** in the belt wrapping direction W. In other words, the third linear portion **29** may be inclined with respect to the second linear portion **27** in the belt wrapping direction W so as to form an angle E (which may be referred to as a supplementary angle of the angle F) therebetween. Thus, the third liner portion **29** may be inwardly obliquely connected to the second linear portion **27** via a bent portion **39**.

[0046] The first angle B, the second angle D and the third angle F may be determined to meet the following requirements:

[0047] 1) the first angle B

portion **20**. Further, the first linear portion **25** of the functional portion of the belt **2** may be specially shaped in cross section. That is, a right (first) side edge **33** of the first linear portion **25** may have a special shape different from a left (second) side edge **35** of the first linear portion **25**. In particular, the right side edge **33** of the first linear portion **25** may have a lower rounded surface **33***a* and an upper slanted surface **33***b* (FIG. **9**). Thus, the right side edge **33** of the first linear portion **25** may be formed into a wedged or tapered shape as a whole. Conversely, the left side edge **35** of the first linear portion **25** may be simply chamfered so as to have a sheer or perpendicular end surface **36**. Further, the second linear portion **27** and the third linear portion **29** of the functional portion of the belt **2** may preferably be formed such that their right side edges (not labeled) respectively have a wedged or tapered shape. Similarly, the base portion **20** of the belt **2** may be formed such that its right side edges (not labeled) has a wedged or tapered shape as necessary. Further, the right side edge **33** and the left side edge **35** of the first liner portion **25** may be referred to as the right side edges **33** and the left side edge **35** of the belt **2** in some situation.

[0048] As shown in FIG. **1**, the third linear portion **29** of the belt **2** may have a plurality of gear tooth-shaped projections **32** that are formed in a central portion of an inner surface **31** thereof. The projections **32** may preferably be arranged at a constant pitch distance in a longitudinal direction of the third linear portion **29**.

[0049] As shown in FIG. **4**, in this embodiment, a length L**2** of the first linear portion **25**, a length L**3** of the second linear portion **27** and a length L**4** of the third linear portion **29** may be determined to be equal to each other. Further, a length of the functional portion of the belt **2** (i.e., a sum of the length L**2** of the first linear portion **25**, the length L**3** of the second linear portion **27** and the length L**4** of the third linear portion **29**, or a difference between an overall length L of the belt **2** and a length L**1** of the base portion **20** of the belt **2**) may be determined to be equal to 28±10 percent of the overall length L of the belt **2**.

[0050] Next, the buckle **4** will be described. As shown in FIGS. **3** and **5**, the buckle **4** may have an open-ended box-shaped member having a belt insertion hole **53** that is centrally vertically (longitudinally) formed therethrough. The belt insertion hole **53** may be configured such that the belt **2** is introduced thereinto. As shown in FIG. **6**, the belt insertion hole **53** may have an inlet end **54** and an outlet end **55** respectively opening to the outside. The belt insertion hole **53** may be configured such that the belt **2** (a distal end **30** of the third linear portion **29**) is inserted thereinto through the inlet end **54**.

[0051] As shown in FIGS. **3** and **6**, the buckle **4** may include a front wall **40**, a rear wall **42**, a right (first) side wall **44** and a left (second) side wall **49**. As shown in FIG. **6**, the front wall **40** may be connected to the proximal end **21** of the base portion **20** of the belt **2** via an upwardly curved concave quadrant arch-shaped thinned portion **40***a* formed on an upper end thereof. Further, the buckle **4** may include an engagement strip **60** formed on a vertical inner surface **41** of the front wall **40**. The engagement strip **60** may be configured to flex back and forth with respect to the front wall **40**. The engagement strip **60** may have an engagement claw **61** formed thereon. The engagement claw **61** may be configured to engage the rack teeth **24** formed on the base portion **20** of the belt **2** when the belt **2** is inserted into the belt insertion hole **53** of the buckle **4** in order to tie together the wiring harness **10**. Further, as shown in FIG. **5**, the engagement claw **61** may have a rounded portion **61***a* formed in a left edge thereof.

[0052] As shown in FIGS. **5** and **6**, the rear wall **42** may be positioned opposite to the front wall across the belt insertion hole **53**. The rear wall **42** may have a laterally rounded surface **43** formed in an upper end thereof and facing the belt insertion hole **53**. The rounded surface **43** may preferably have the substantially same width as a width of the belt **2**. The rounded surface **43** may contribute to easy insertion of the belt **2** into the belt insertion hole **53**.

[0053] As shown in FIG. **5**, the right side wall **44** may be connected to a right end of the front wall **40** and a right end

of the rear wall **42**. As shown in FIG. **1**, the right side wall **44** may include a laterally outwardly projected horizontal (first) projected portion **47** that is formed on an outer surface thereof so as to extend along an upper end periphery thereof. Further, the right side wall **44** may include a laterally outwardly projected vertical (second) projected portion **48** formed on the outer surface thereof and integrated with the horizontal projected portion **47**. Thus, as shown in FIG. **5**, the right side wall **44** may have a thickness T**1** that is substantially greater than a thickness T**2** of the rear end wall **42** and a thickness T**3** of the left side wall **49**.

[0054] As shown in FIG. **3**, the left side wall **49** may be positioned laterally opposite to the right side wall **44**. The left side wall **49** may be connected to a left end of the front wall **40** and a left end of the rear wall **42**. As shown in FIGS. **3** and **5**, the left side wall **49** may be vertically divided in a central portion thereof, so as to be formed into two (front and rear) separate wall portions (not labeled). Thus, the left side wall **49** may have a vertical slot **56** formed between the front wall portion and the rear wall portion. The vertical slot **56** may extend along the entire length of the left side wall **49** so as to be continuous with the belt insertion hole **53** over the entire length thereof. The vertical slot **56** thus formed allows the belt **2** to be laterally introduced into the belt insertion hole **53** as necessary. Therefore, the belt **2** may be introduced into the belt insertion hole **53** not only through the inlet end **54** of the belt insertion hole **53** but also through the vertical slot **56** formed in the left side wall **49**.

[0055] As shown in FIG. **5**, the rear wall portion of the left side wall **49** may be specially shaped. In particular, the rear wall portion may have a projection or overhang **50** formed therealong and projecting into the belt insertion hole **53**. The overhang **50** may have an inclined (inner) surface **51** hanging over and facing the belt insertion hole **53**. Further, the overhang **50** may preferably have a height H equal to approximately 80 percent of a height (thickness) H**1** of the left side edge of the belt **2**.

[0056] As shown in FIG. **5**, the front and rear wall portions of the left side wall **49** may respectively have a front vertically elongated projection **52***a* and a rear vertically elongated projection **52***b*. The front projection **52***a* and the rear projection **52***b* may respectively have vertical surfaces **59***a* and **59***b* facing each other. Further, the vertical surface **59***a* of the front vertical projection **52***a* may be curved frontward and leftward (outward) while the vertical surface **59***b* of the rear vertical projection **52***b* may be curved rearward and leftward (outward). Thus, the vertical slot **56** formed in the left side wall **49** may be gradually widened leftward (outward), so as to have a flared inlet opening **57**.

[0057] Next, a standard operation for tying together the wiring harness **10** using the cable tie **1** will be described. First, the belt **2** may be applied to the wiring harness **10** from below so as to intersect with the wiring harness **10** at a substantially right angle. The belt **2** may then be looped around the wiring harness **10** in the belt wrapping direction W. Thereafter, the distal end **30** of the third linear portion **29** of the belt **2** looped around the wiring harness **10** may be introduced into the belt insertion hole **53** of the buckle **4** through the inlet end **54** of the belt insertion hole **53**. Next, the distal end **30** of the third linear portion **29** introduced into the belt insertion hole **53** may be pulled and drawn from the belt insertion hole **53** through the outlet end **55** of the belt insertion hole **53**. As a result, the third linear portion **29**, the second linear portion **27** and the first linear portion **25** of the belt **2** may be sequentially introduced into the belt insertion hole **53**. When the distal end **30** of the third linear portion **29** of the belt **2** is further pulled, the base portion **20** of the belt **2** may be introduced into the belt insertion hole **53** while flexing the engagement strip **60** formed in the belt insertion hole **53** back and forth. As a result, the belt **2** (the base portion **20**) may be gradually fastened while being wrapped around the wiring harness Thereafter, when the pulling operation of the belt **2** is stopped after the belt **2** is fastened to some extent, the engagement claw **61** formed on the engagement strip **60** may elastically engage one of the rack teeth **24** formed on the base portion **20** of the belt **2**, so that the belt **2** may be fastened and locked by the buckle **4**. Thus, the wiring harness **10** may be temporarily or substantially tied together by the cable tie **1**. Further, as previously described, the buckle **4** is connected to the belt **2** via the thinned portion **40***a*. Therefore, when the belt **2** is fastened, stress produced in the belt **2** may be effectively reduced or dispersed by the thinned portion **40***a*.

[0058] Preferably, the belt **2** may be further fastened by using a specialized fastening tool (not shown) such that the wiring harness **10** can be completely tied together by the cable tie **1**. In particular, a mouthpiece or tool head of the specialized tool may be fitted to the outlet end **55** of the belt insertion hole **53**. Thereafter, the fastening tool may be operated, so as to further fasten the belt **2**. When the belt **2** is sufficiently fastened, the engagement claw **61** of the buckle **4** may elastically engage another of the rack teeth **24** of the belt **2**, so that the belt **2** may be sufficiently fastened and ultimately locked by the buckle **4**. Thus, the wiring harness **10** may be securely tied together by the cable tie **1**. Further, the belt **2** may be ultimately fastened by hand without using the fastening tool as necessary.

[0059] Generally, after the belt **2** is locked by the buckle **4**, an excess portion of the belt **2** (i.e., a distal portion (not labeled) of the base portion **20** including the functional portion) drawn from the outlet end **55** of the belt insertion hole **53** of the buckle **4** may preferably be cut off by using cutting tools, e.g., nippers or scissors (not shown).

[0060] The wiring harness **10** is sometimes positioned adjacent to a wall-like obstacle **70** (e.g., a structural member such as a vehicle body panel). Next, an operation for tying together the wiring harness **10** using the cable tie **1** in such a case will be hereinafter described with reference to FIGS. **4** and **7** to **9**. As shown in FIG. **4**, first, the belt **2** may be applied to the wiring harness **10** from below in such a manner that the belt **2** intersects with the wiring harness **10** at a substantially right angle. In particular, the belt **2** may be positioned under the wiring harness **10** in such a manner that the distal end **30** of the third linear portion **29** of the belt **2** may contact the obstacle **70**. At this time, the third linear portion **29** may be inclined at an angle with respect to the obstacle **70**.

[0061] When the belt **2** is longitudinally pressed to the obstacle **70** in this condition (the condition shown in FIG. **4**), a pressing force applied to the belt **2** may substantially be concentrated to the bent portion **39** formed between the third liner portion **29** and the second linear portion **27**. As a result, the third linear portion **29** may come into contact with the obstacle while relatively flexing with respect to the second linear portion **27** (solid lines in FIG. **7**). Upon contact of the third linear portion **29** with the obstacle **70**, the distal end **28** of the second linear portion **27** may come into contact with

the obstacle **70** in a condition in which while the second linear portion **27** is inclined at an angle with respect to the obstacle **70**.

[0062] When the belt **2** is further pressed to the obstacle **70** in this condition, the pressing force applied to the belt **2** may substantially be concentrated to the bent portion **38** formed between the second liner portion **27** and the first linear portion **25**. As a result, the second linear portion **27** may come into contact with the obstacle **70** while relatively flexing with respect to the first linear portion **25** (shown by chain double-dashed lines in FIG. **7**). At this time, as shown by chain double-dashed lines in FIG. **7**, due to the pressing force applied to the belt **2**, the base portion **20** of the belt **2** may be flexed or deflected upward, i.e., in the belt wrapping direction W, in a middle portion thereof. Therefore, the second linear portion **27** may come into contact with the obstacle **70** while moving or sliding upward along the obstacle **70**. Upon contact of the second linear portion **27** with the obstacle **70**, the distal end **26** of the first linear portion **25** may come into contact with the obstacle **70** in a condition in which the first linear portion **25** is inclined at an angle with respect to the obstacle **70**. Conversely, the third linear portion **29** may be spaced from the obstacle **70** so as to obliquely extend from the obstacle **70** in the belt wrapping direction W because the third linear portion **29** is inclined at the angle F with respect to the second liner portion **27** in the belt wrapping direction W.

[0063] When the belt **2** is further pressed to the obstacle **70** in this condition, the pressing force applied to the belt **2** may substantially be concentrated to the bent portion **37** formed between the first liner portion **25** and the base portion **20**. As a result, the first linear portion **25** may come into contact with the obstacle **70** while relatively flexing with respect to the base portion **20** (shown by solid lines in FIG. **8**). At this time, as shown by solid lines in FIG. **8**, due to the pressing force applied to the belt **2**, the base portion **20** may be arcuately flexed upward in the middle portion thereof. Therefore, the first linear portion **25** may come into contact with the obstacle **70** while moving or sliding upward along the obstacle **70**. Upon contact of the first linear portion **25** with the obstacle **70**, the distal end **22** of the base portion **20** may come into contact with the obstacle **70** in a condition in which the base portion **20** is inclined at an angle with respect to the obstacle **70**. Conversely, the second linear portion **27** may be spaced from the obstacle **70** so as to obliquely extend from the obstacle **70** in the belt wrapping direction W because the second linear portion **27** is inclined at the angle D with respect to the first liner portion **25** in the belt wrapping direction W.

[0064] When the belt **2** is further pressed to the obstacle **70** in this condition, due to the pressing force applied to the belt **2**, the distal portion of the base portion **20** may come into contact with the obstacle **70** (shown by chain double-dashed lines in FIG. **8**). At this time, as shown by chain double-dashed lines in FIG. **8**, due to the pressing force applied to the belt **2**, the middle portion of the base portion **20** may be further arcuately flexed upward. Therefore, the distal portion of the base portion **20** may come into contact with the obstacle **70** while moving or sliding upward along the obstacle **70**. Upon contact of the distal portion of the base portion **20** with the obstacle the first linear portion **25** may be spaced from the obstacle **70** so as to obliquely extend from the obstacle **70** in the belt wrapping direction W because the first linear portion **25** is inclined at the angle B with respect to the base portion **20** in the belt wrapping direction W.

[0065] Thus, when the belt **2** is longitudinally pressed to the obstacle **70** in the condition in which the distal end **30** of the third linear portion **29** of the belt **2** contacts the obstacle **70** (FIG. **4**), the third linear portion **29**, the second linear portion **27** and the first linear portion **25** may be pressed against and spaced away from the obstacle **70** in a stepwise fashion while sliding upward along the obstacle **70**, so as to continuously extend backward (i.e., toward the buckle **4**) from the obstacle **70** in this order. As shown by chain double-dashed lines in FIG. **8**, when the belt **2** is pressed to the obstacle **70** until the distal portion of the base portion **20** of the belt **2** comes into contact with the obstacle **70**, all of the third linear portion **29**, the second linear portion **27** and the first linear portion **25** may be spaced from the obstacle **70** so as to substantially arcuately extend backward (i.e., toward the buckle **4**) from the obstacle **70**. This means that the third linear portion **29**, the second linear portion **27** and the first linear portion **25** may extend in the belt wrapping direction W around the wiring harness **10** in this order. Further, each of the first linear portion **25**, the second linear portion **27** and the third linear portion **29** may have a substantial length. Therefore, the third linear portion **29**, the second linear portion **27** and the first linear portion **25** may extend backward from the obstacle **70** over a desired distance.

[0066] According to the cable tie **1**, even if the wiring harness **10** is positioned adjacent to the obstacle **70**, a worker can easily pinch or hold the distal end **30** (which may be referred to as a distal end portion of the belt **2**) of the third linear portion **29** of the belt **2** applied to the wiring harness **10** from below by the fingers in order to wrap the belt **2** around the wiring harness **10**. Therefore, the worker can quickly wrap the belt **2** around the wiring harness **10** by holding the distal end **30** of the third linear portion **29**, thereby tying together the wiring harness **10**.

[0067] Further, the distal end **30** of the third linear portion **29** of the belt **2** looped around the wiring harness **10** sometimes cannot be vertically introduced into the belt insertion hole **53** of the buckle **4** through the inlet end **54** of the belt insertion hole **53**. In such a case, in order to tie together the wiring harness **10** using the cable tie **1**, the belt **2** may be laterally introduced into the belt insertion hole **53** of the buckle **4** through the vertical slot **56** formed in the left side wall **49**. In particular, the belt **2** may be applied to the wiring harness **10** from below. The belt **2** may then be looped around the wiring harness **10** in the belt wrapping direction W. Thereafter, the first linear portion **25** of the belt **2** looped around the wiring harness **10** may be laterally introduced into the belt insertion hole **53** of the buckle **4** through the vertical slot **56** formed in the left side wall **49** (FIG. **9**). Thereafter, the wiring harness **10** may be tied together by the cable tie **1** in the same manner as the standard operation described above. Thus, even in the case where the distal end **30** of the third linear portion **29** of the belt **2** looped around the wiring harness **10** cannot be vertically introduced into the belt insertion hole **53** of the buckle **4** through the inlet end **54** of the belt insertion hole **53**, the wiring harness **10** can be easily and reliably tied together by the cable tie **1**.

[0068] As previously described, the right side edge **33** of the first linear portion **25** may have the lower rounded

surface **33***a* and the upper slanted surface **33***b* (FIG. **9**), so as to have the tapered shape as a whole. Therefore, the first linear portion **25** of the belt **2** may be easily and smoothly inserted into the vertical slot **56**. Further, the vertical slot **56** may have the flared inlet opening **57**. This may also contribute to easy insertion of the first linear portion **25** of the belt **2** into the vertical slot **56**. Thus, the first linear portion **25** of the belt **2** looped around the wiring harness may be easily and smoothly introduced into the belt insertion hole **53** of the buckle **4** through the vertical slot **56** formed in the left side wall **49** of the buckle **4**.

[0069] Further, as previously described, the overhang **50** formed in the rear wall portion **52***b* of the left side wall **49** of the buckle **4** may have the height H equal to approximately 80 percent of the height H**1** of the right side edge **35** of the first linear portion **25** of the belt **2**. Therefore, the first linear portion **25** of the belt **2** introduced into the belt insertion hole **53** of the buckle **4** may be effectively prevented from being disengaged or slipped from the buckle **4** via the vertical slot **56**.

[0070] According to the cable tie **1** of the first embodiment, the belt **2** may include the base portion **20** and the functional portion. The functional portion may include the first linear portion the second linear portion **27** and the third linear portion **29** that are connected to each other at the predetermined angles (i.e., the angle D and the angle F). Further, the first liner portion **25** of the functional portion may be connected to the base portion **20** at the predetermined angle (i.e., the angle B). Therefore, in the case where the wiring harness **10** is positioned adjacent to the obstacle **70**, when the belt **2** positioned under the wiring harness **10** is pressed to the obstacle **70** after the distal end **30** of the third linear portion **29** of the belt **2** contacts the obstacle **70**, the third linear portion **29**, the second linear portion **27** and the first linear portion **25** may turn stepwise at the obstacle **70** in this order so as to gradually overhang the wiring harness **10** in the belt wrapping direction W. Further, the third linear portion **29** may be inclined at an angle equal to a sum of the angles B, D and F with respect to the obstacle **70**. Therefore, even if the wiring harness **10** is positioned adjacent to the obstacle **70**, the worker can easily and quickly wrap the belt **2** around the wiring harness **10** by holding the distal end **30** of the third linear portion **29**.

[0071] Further, the first angle B, the second angle D and the third angle F are respectively determined to 10 degrees, 20 degrees and 30 degrees. In addition, the length L**2** of the first linear portion **25**, the length L**3** of the second linear portion **27** and the length L**4** of the third linear portion **29** are determined to be substantially equal to each other. Therefore, the third linear portion **29**, the second linear portion **27** and the first linear portion **25** (i.e., the functional portion of the belt **2**) may be well-balanced in structure and function.

[0072] Further, the sum of the length L**2** of the first linear portion **25**, the length L**3** of the second linear portion **27** and the length L**4** of the third linear portion **29** (i.e., the length of the functional portion of the belt **2**) may be determined to be equal to 28±10 percent of the overall length L of the belt **2**. Such a ratio of the length of the functional portion of the belt **2** to the overall length L of the belt **2** may contribute to an increase in function of the functional portion of the belt **2** and an increase in ease of handling of the belt **2**.

[0073] Further, the buckle **4** may include the vertical slot **56** that is continuous with the belt insertion hole **53**. Therefore, the belt **2** can be laterally introduced into the belt insertion hole **53** of the buckle **4** through the vertical slot **56** instead of the inlet end **54**. Further, the vertical slot **56** may have the flared inlet opening **57**. Therefore, the belt **2** can be easily and smoothly introduced into the belt insertion hole **53** of the buckle **4** through the vertical slot **56**.

[0074] Further, the right side edge **33** of the belt **2** may have the tapered shape. Therefore, the belt **2** can be easily and smoothly introduced into the belt insertion hole **53** of the buckle **4** through the vertical slot **56**.

[0075] Further, the buckle **4** may include the right side wall **44** having the thickness T**1** greater than the thickness T**2** of the rear end wall **42** and the thickness T**3** of the left side wall **49**. Therefore, the buckle **4** may have a desired strength regardless of the presence of the vertical slot **56** formed in the left side wall **49**.

[0076] Further, the left side wall **49** of the buckle **4** may have the overhang **50** formed in rear wall portion and hanging over the belt insertion hole **53**. The overhang **50** may have the inclined surface **51** facing the belt insertion hole **53**. Further, the overhang **50** may have the height H equal to approximately 80 percent of the height H**1** of the left side edge **35** of the belt **2**. Therefore, the overhang **50** may effectively interfere with the left side edge **35** of the belt **2** introduced into the belt insertion hole **53**, thereby preventing the belt **2** from being disengaged or slipped from the buckle **4** through the vertical slot **56**.

[0077] Further, the vertical slot **56** of the buckle **4** may have the flared inlet opening **57**. Therefore, the belt **2** can be easily introduced into the belt insertion hole **53** of the buckle **4** through the vertical slot **56**.

[0078] Next, a second detailed representative embodiment will now be described with reference to FIGS. **10** to **13**. Further, because the second embodiment relates to the first embodiment, only the constructions and elements that are different from the first embodiment will be explained in detail. Elements that are the same in the first and second embodiments will be identified by the same reference numerals and a detailed description of such elements may be omitted.

[0079] Similar to the cable tie **1** of the first embodiment, a cable tie **101** of the second embodiment may be integrally formed as a unit by integral molding of a rigid synthetic resin. The cable tie **101** may include a desired length of flexible belt **102** and the buckle **4**. The cable tie **101** may be different from the cable tie **1** of the first embodiment in that the belt **102** is structurally different from the belt **2** of the first embodiment. In particular, as shown in FIGS. **10** to **13**, unlike the first embodiment, the functional portion of the belt **102** may include only the first linear portion **25** and the second linear portion **27**. Further, in this embodiment, the second linear portion **27** may have the gear tooth-shaped projections **32** that are formed in a central portion of an inner surface thereof. The projections **32** may preferably be arranged at a constant pitch distance in a longitudinal direction of the second linear portion **27**.

[0080] As shown in FIG. **10**, similar to the first embodiment, the first linear portion **25** may be inclined at the (first) angle B with respect to the base portion **20** in the belt wrapping direction W. Further, the second linear portion **27** may be inclined at the (second) angle D with respect to the first liner portion **25** in the belt wrapping direction W.

[0081] However, in this embodiment, the first angle B and the second angle D may respectively be determined to 30

degrees. Generally, the angle B and the angle D may be determined to meet the following requirements:

[0082] 1) the angle B the angle D

[0083] 2) the angle B+the angle D 90 degrees.

[0084] As shown in FIG. **10**, in this embodiment, the length L**2** of the first linear portion **25** is determined to be greater than the length L**3** of the second linear portion **27**. Further, the length of the functional portion of the belt **102** (i.e., a sum of the length L**2** of the first linear portion **25** and the length L**3** of the second linear portion **27**, or a difference between the overall length L of the belt **102** and the length L**1** of the base portion **20** of the belt **102**) may be determined to be equal to 28±10 percent of the overall length L of the belt **102**. Further, the length L**2** of the first linear portion **25** may be determined to be equal to or smaller than the length L**3** of the second linear portion **27** as necessary.

[0085] According to the cable tie **101**, in a condition where the belt **102** is positioned under the wiring harness **10** with the distal end **28** of the second linear portion **27** contacting the obstacle (FIG. **10**), when the belt **102** is longitudinally pressed to the obstacle **70**, the second linear portion **27** and the first linear portion **25** may be pressed against and spaced away from the obstacle **70** in a stepwise fashion while sliding upward along the obstacle **70**, so as to continuously extend backward (i.e., toward the buckle **4**) from the obstacle **70** in this order (FIGS. **11** to **13**). As shown in FIG. **13**, when the belt **102** is pressed to the obstacle **70** until the distal portion of the base portion **20** of the belt **102** comes into contact with the obstacle **70**, both of the second linear portion **27** and the first linear portion **25** may be spaced away from the obstacle **70** so as to substantially arcuately extend backward (i.e., toward the buckle **4**) from the obstacle **70**. This means that the second linear portion **27** and the first linear portion **25** may extend in the belt wrapping direction W around the wiring harness **10** in this order. Further, each of the first linear portion **25** and the second linear portion **27** may have a substantial length. Therefore, the second linear portion **27** and the first linear portion **25** may extend backward from the obstacle **70** over a desired distance.

[0086] Further, according to the cable tie **101**, even if the wiring harness **10** is positioned adjacent to the obstacle **70**, the worker can easily pinch or hold the distal end **28** (which may be referred to as a distal end portion of the belt **102**) of the second linear portion **27** of the belt **102** applied to the wiring harness **10** from below by the fingers in order to wrap the belt **102** around the wiring harness **10**. Therefore, the worker can quickly wrap the belt **102** around the wiring harness **10** by holding the distal end **28** of the second linear portion **27**, thereby tying together the wiring harness **10**. Further, even in a case where the distal end **28** of the second linear portion **27** of the belt **102** looped around the wiring harness **10** cannot be vertically introduced into the belt insertion hole **53** of the buckle **4** through the inlet end **54** of the belt insertion hole **53**, the first linear portion **25** of the belt **102** may be laterally introduced into the belt insertion hole **53** of the buckle **4** through the vertical slot **56** formed in the left side wall **49**. Therefore, even in such a case, the wiring harness **10** can be easily and reliably tied together by the cable tie **101**.

[0087] Next, a third detailed representative embodiment will now be described with reference to FIG. **14**. Further, because the third embodiment relates to the second embodiment, only the constructions and elements that are different from the first embodiment will be explained in detail. Elements that are the same in the first and second embodiments will be identified by the same reference numerals and a detailed description of such elements may be omitted.

[0088] A cable tie **201** of the third embodiment may include a desired length of flexible belt **202** and the buckle **4**. The cable tie **201** may be different from the cable tie **101** of the second embodiment in that the belt **202** is structurally different from the belt **102** of the second embodiment. In particular, unlike the second embodiment, the first angle B may be determined to 25 degrees. The cable tie **201** may have the substantially same function as the cable tie **101** of the second embodiment.

[0089] Next, a fourth detailed representative embodiment will now be described with reference to FIG. **15**. Further, because the fourth embodiment relates to the first embodiment, only the constructions and elements that are different from the first embodiment will be explained in detail. Elements that are the same in the first and fourth embodiments will be identified by the same reference numerals and a detailed description of such elements may be omitted.

[0090] A cable tie **301** of the fourth embodiment may include a desired length of flexible belt **302** and the buckle **4**. The cable tie **301** may be different from the cable tie **1** of the first embodiment in that the belt **302** is structurally different from the belt **2** of the first embodiment. In particular, unlike the first embodiment, each of the second angle D and the third angle F may be determined to 10 degrees. The cable tie **301** may have the substantially same function as the cable tie **1** of the first embodiment.

[0091] Next, a fifth to eighth detailed representative embodiments will now be described with reference to FIGS. **26** to **29**. Further, because the fifth to eighth embodiments respectively relate to the first to fourth embodiments, only the constructions and elements that are different from the first to fourth embodiments will be explained in detail. Elements that are the same in the first to fourth embodiments and the fifth to eighth embodiments will be identified by the same reference numerals and a detailed description of such elements may be omitted.

[0092] As shown in FIG. **26**, in a cable tie **1'** of the fifth embodiment, the buckle **4** may be replaced with a buckle **4'** in which the slot **56** is omitted. Similarly, shown in FIGS. **27** to **29**, in a cable tie **101'** of the sixth embodiment, a cable tie **201'** of the seventh embodiment and a cable tie **301'** of the eighth embodiment, the buckle **4** may be replaced with the buckle **4'** in which the slot **56** is omitted.

[0093] Naturally, various changes and modifications may be made to the present disclosure without departing from the scope of the disclosure. For example, in the first embodiment, the functional portion of the belt **2** may include a fourth linear portion connected to the distal end **30** of the third linear portion **29** and inclined at a fourth angle with respect to the third linear portion **29**. In such a case, the first angle B, the second angle D, the third angle F and the fourth angle may be determined to meet the requirements "the first angle B the second angle D the third angle F the fourth angle" and "the first angle B+the second angle D+the third angle F+the fourth angle 90 degrees." Further, the functional portion of the belt **2** may include additional linear portions in addition to the fourth linear portion.

[0094] Further, in the first embodiment, the length L**2** of the first linear portion **25**, the length L**3** of the second linear portion **27** and the length L**4** of the third linear portion **29** may be determined to be equal to each other. However, the

length L2, the length L3 and the length L4 may be determined to be different from each other at a difference of up to 10 percent.

[0095] Further, in the first embodiment, the left side edge **35** of the first linear portion **25** may have the perpendicular end surface **36** (FIG. **9**). However, as shown in FIG. **16** (a first modified embodiment), the left side edge **35** of the first linear portion **25** may have a slanted end surface **36'** that is configured to be parallel to the inclined surface **51** of the overhang **50** when the belt **2** is introduced into the belt insertion hole **53** of the buckle **4**. According to the modified embodiment of the first embodiment, the belt **2** introduced into the belt insertion hole **53** of the buckle **4** may be more effectively prevented from being disengaged or slipped from the buckle **4** through the vertical slot **56**. Similarly, in each of the second to fourth embodiment, the left side edge **35** of the first linear portion **25** may be modified in the same manner as the first embodiment.

[0096] The first embodiment may be further modified. In particular, as shown in FIG. **17** (a second modified embodiment), the right side edge **33** of the belt **2** may be partially removed in the first linear portion **25**, thereby forming a cutout or removed portion **25***a* that penetrates the first linear portion **25** in a belt thickness direction. The removed portion **25***a* may serve as a sign that indicates a position of the first linear portion **25**. Therefore, the worker can easily and reliably introduce the first linear portion **25** into the belt insertion hole **53** of the buckle **4** through the vertical slot **56** with the help of the removed portion **25***a* even when the worker cannot see the first linear portion **25**. Similarly, in each of the second to fourth embodiment, the right side edge **33** of the first linear portion **25** may be modified in the same manner as the first embodiment.

[0097] Further, the removed portion **25***a* formed in the first linear portion **25** may be variously changed in shape. For example, as shown in FIG. **18**, the removed portion **25***a* may be changed to a shallow rectangular recessed portion **25***a'* that does not penetrate the first linear portion **25** in the belt thickness direction. Further, as shown in FIG. **19**, the removed portion **25***a* may be changed to a semicircular recessed portion **25***a"* that does not penetrate the first linear portion **25** in the belt thickness direction. Further, as shown in FIG. **20**, the removed portion **25***a* may be changed to a deep rectangular recessed portion **25***a'"* that does not penetrate the first linear portion **25** in the belt thickness direction.

[0098] The first embodiment may be further modified. In particular, as shown in FIGS. **21** and **22** (a third modified embodiment), at least one of the front wall portion (the front vertical projection **52***a*) and the rear wall portion (the rear vertical projection **52***b*) of the left side wall **49** of the buckle **4** may be modified. For example, the front wall portion of the left side wall **49** of the buckle **4** may have a triangular chamfered portion or inclined surface (D) that extends over an upper surface (A), an inner surface (B) and an outer surface (C) thereof. Further, the inner surface (B) may include the vertical surface **59***a* of the front vertical projection **52***a* formed in the front wall portion of the left side wall **49**. The inclined surface (D) may contribute to easy insertion of the first linear portion **25** of the belt **2** into the vertical slot **56**. Similarly, in each of the second to fourth embodiment, the buckle **4** may be modified in the same manner as the first embodiment.

[0099] Further, the inclined surface (D) formed in the front wall portion of the left side wall **49** may be variously changed or modified in shape. For example, as shown in FIG. **23**, the inclined surface (D) may have a laterally elongated triangular shape. Further, as shown in FIG. **24**, the inclined surface (D) may have a rectangular shape. Further, as shown in FIG. **25**, the front wall portion of the left side wall **49** of the buckle **4** may have a cutout (E) instead of the inclined surface (D).

[0100] Further, the cable tie **1** of the first embodiment may be modified. In particular, the buckle **4** may be provided with a connecting member (e.g., an anchor), so as to be connected to a vehicle body. According to the cable tie **1** thus modified, the wiring harness **10** tied together by the cable tie **1** can be secured to the vehicle body via the connecting member.

[0101] Representative examples of the present disclosure have been described in detail with reference to the attached drawings. This detailed description is merely intended to teach a person of skill in the art further details for practicing preferred aspects of the present disclosure and is not intended to limit the scope of the disclosure. Only the claims define the scope of the claimed disclosure. Therefore, combinations of features and steps disclosed in the foregoing detail description may not be necessary to practice the disclosure in the broadest sense, and are instead taught merely to particularly describe detailed representative examples of the disclosure. Moreover, the various features taught in this specification may be combined in ways that are not specifically enumerated in order to obtain additional useful embodiments of the present disclosure.

What is claimed is:

1. A cable tie, comprising:

a desired length of belt configured to be wrapped around a bundle of tied articles; and

a buckle connected to a proximal end portion of the belt and having a belt insertion hole into which the belt is introduced,

wherein the belt includes a base portion linearly extending from the buckle and a functional portion having a first linear portion and a second linear portion,

wherein the first linear portion is connected to a distal end of the base portion at a proximal end thereof,

wherein the second linear portion is connected to a distal end of the first liner portion at a proximal end thereof,

wherein the first linear portion is inclined at a first angle with respect to the base portion in a belt wrapping direction,

wherein the second linear portion is inclined at a second angle with respect to the first liner portion in the belt wrapping direction, and

wherein the first angle is determined to be equal to or smaller than the second angle.

2. The cable tie as defined in claim **1**, wherein the functional portion includes a third linear portion,

wherein the third linear portion is connected to a distal end of the second linear portion at a proximal end thereof,

wherein the third linear portion is inclined at a third angle with respect to the second liner portion in the belt wrapping direction, and

wherein the second angle is determined to be equal to or smaller than the third angle.

3. The cable tie as defined in claim **1**, wherein a length of the functional portion of the belt is determined to be equal to 28±10 percent of an overall length of the belt.

4. The cable tie as defined in claim **1**, wherein a length of the first linear portion is determined to be greater than a length of the second linear portion.

5. The cable tie as defined in claim **2**, wherein a length of the first linear portion, a length of the second linear portion and a length of the third linear portion may be determined to be equal to each other.

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