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(54) Compound needle for flatbed knitting machine

(57) A compound needle (1) for a flatbed knitting machine can delay an operation of removing dust from a space (39) on one side of a curved portion (371) of a sliding-resistance application plate (37) by restraining the space from being bulged to the other side by accumulated dust. A slider (3) includes a slider base body (31), two blades (32, 33) supported by the slider base body (31) and extending rearward, a sliding-resistance application plate (37) that extends rearward with a front end extending integrally from one of the blades (32, 33) and that applies a sliding resistance by bringing the curved portion (371) into sliding contact with a needle plate (11), a fixing portion (43) provided in the slider base body (31) to fix a front end of the sliding-resistance application plate (37) from one side, and a sliding contact portion (44) provided in the slider base body (31) such that a rear end of the sliding-resistance application plate (37) is in sliding contact with the sliding contact portion (44) from the one side. The slider base body (31) further includes a connecting portion (311) that extends above the curved portion (371) to connect the fixing portion (43) and the sliding contact portion (44). The connecting portion (311) is cut off on one side of the curved portion (371).

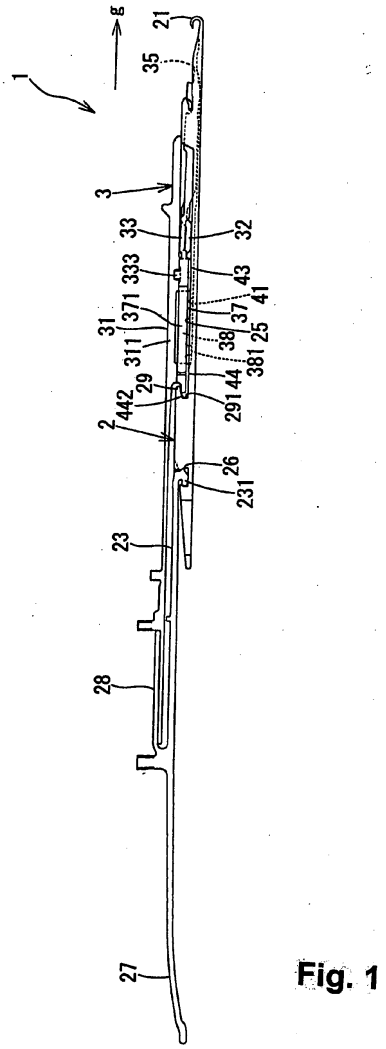

Fig. 1

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a compound needle for use in a flatbed knitting machine.

2. Description of the Related Art

[0002] As a knitting needle for a flatbed knitting machine, a compound needle including a needle body and a slider, which move relative to each other in a front-rear direction, is used sometimes. The compound needle is received in a needle groove of a needle bed in the flatbed knitting machine. The slider includes a slider base body and two blades supported by the slider base body and superposed on each other. These blades are slidably received in a slider groove extending in the front-rear direction on a needle bed gap side (front side) of the needle body. In this case, when transfer of a loop is performed, the blades are opened in a right-left direction by being advanced in contact with side faces of a tip of a hook of the needle body, and, between the blades that have advanced beyond the hook, the needle on the needle bed opposing the blades is advanced.

[0003] However, when the blades are opened in the right-left direction by advancing the slider in the compound needle, dust, such as fly waste, is likely to be produced between the blades because knitting yarn rubs against the hook, for example, during transfer. For this reason, dust is attached to the hook of the needle and accumulates around the hook.

[0004] In view of this point, Japanese Patent No. 3983737 has proposed a compound needle in which a dust-collecting plate is provided between blades.

[0005] Dust attached to the hook and dust accumulated around the hook tend to be sequentially fed to a rear side of the needle body in association with relative movement of the needle body and the slider in the front-rear direction, regardless of whether or not the dust-collecting plate is provided.

[0006] In this case, at least one of the blades sometimes includes a sliding-resistance application plate that applies a sliding resistance by sliding contact of a curved portion, which projects in a substantially arc-form, during movement of the slider. On one side of the curved portion of the sliding-resistance application plate, a space is defined by the curved portion, and the slider base body or the other blade. Dust sequentially sent to the rear side of the needle body is likely to accumulate in this space, and the space is bulged to the one side of the curved portion by the accumulated dust. However, since the slider base body is provided on one side of the space, bulging of the space to the one side of the curved portion due to the accumulated dust is hindered by contact with the slider base body. In this case, the space bulges to the other side of the curved portion (a side opposite the space), the sliding resistance of the curved portion increases, and the motion of the compound needle is worsened. For this reason, to keep smooth motion of the compound needle, it is necessary to remove dust from the space before the space is bulged to the other side by the accumulated dust.

SUMMARY OF THE INVENTION

[0007] Accordingly, it is an object of the present invention to provide a compound needle for a flatbed knitting machine, which delays an operation of removing dust from a space by restraining the space from being bulged to an undesirable side by accumulated dust.

[0008] To achieve the above object, a compound needle according to the present invention includes a needle body and a slider that are received in a needle groove of a needle bed in a flatbed knitting machine and that move relative to each other in a front-rear direction. The slider includes a slider base body, two blades that are supported by the slider base body, are slidably received in a slider groove extending in the front-rear direction on a needle bed gap side of the needle body, and extend rearward, a sliding-resistance application plate that extends integrally or separately from a rear end of at least one of the blades and applies a sliding resistance by sliding contact of a curved portion curved in a substantially arc-form during movement of the slider, a fixing portion provided in the slider base body to fix one of front and rear ends of the sliding-resistance application plate from one side, and a sliding contact portion provided in the slider base body such that the other end is in sliding contact with the sliding contact portion from the one side. The slider base body further includes a connecting portion that extends above or below the curved portion to connect the fixing portion and the sliding contact portion. The connecting portion is cut off on one side of the curved portion.

[0009] Preferably, the sliding-resistance application plate extends from the rear end of only one of the blades.

[0010] Preferably, a gap is provided between the curved portion of the sliding-resistance application plate and the connecting portion of the slider base body.

[0011] Preferably, the sliding contact portion or the sliding-resistance application plate in sliding contact with the sliding contact portion has a cutout or a hole.

[0012] According to the present invention, since the connecting portion for connecting the fixing portion and the sliding contact portion in the slider base body is cut off on one side of the curved portion, bulging of a space to the one side of the curved portion due to accumulated dust is not hindered by the slider base body. Thus, the space is unlikely to bulge to the other side, the motion of the compound needle is kept smooth, and an operation of removing dust from the space can be delayed.

[0013] Moreover, since the fixing portion and the sliding contact portion are connected by the connecting portion extending above or below the curved portion, the

distance between the fixing portion and the sliding contact portion in the front-rear direction can be arbitrarily set in accordance with the length of the connecting portion. Thus, the length in the front-rear direction of the curved portion of the sliding-resistance application plate can be increased, and the sliding resistance of the curved portion to a needle plate can be set easily.

[0014] Since the sliding-resistance application plate extends from only one of the blades, the space on one side of the curved portion of the sliding-resistance application plate is extended to the needle plate on the one side. Moreover, dust accumulated in the space moves in the front-rear direction in association with sliding of the slider. For this reason, dust in the space is easily discharged, and, even when dust accumulates in the space, it is possible to play for sufficient time until the space is filled with the dust. This can further delay the operation of removing dust from the space.

[0015] Since the gap is provided between the curved portion of the sliding-resistance application plate and the connecting portion of the slider base body, dust accumulated in the space is easily discharged through the gap, and the operation of removing dust from the space can be delayed further.

[0016] In addition, since the sliding contact portion, or the other of the front and rear ends of the sliding-resistance application plate in sliding contact with the sliding contact portion has the cutout or the hole, even when dust accumulates in the space, the accumulated dust is easily discharged from the cutout or the hole of the sliding contact portion or the sliding-resistance application plate. This can further delay the operation of removing dust from the space.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

Fig. 1 is a side view of a compound needle for a flatbed knitting machine according to a first embodiment of the present invention, as viewed in a direction in which needle grooves are arranged in parallel;

Fig. 2 is an exploded side view of the compound needle of Fig. 1;

Fig. 3A is an enlarged view of blades and their surroundings in the compound needle of Fig. 1, and Fig. 3B is a bottom view of a sliding-resistance application plate and its surroundings in the compound needle, as viewed from a needle bed side;

Fig. 4A is an enlarged side view of blades and their surroundings in a compound needle according to a modification of the first embodiment, and Fig. 4B is a bottom view of a sliding-resistance application plate and its surroundings in the compound needle of the modification;

Figs. 5A to 5C are enlarged side views of blades and their surroundings in compound needles according to other modifications of the first embodiment;

Fig. 6 is a side view of a compound needle for a flatbed knitting machine according to a second embodiment of the present invention;

Fig. 7 is an exploded side view of the compound needle of Fig. 6; and

Fig. 8A is an enlarged side view of blades and their surroundings in the compound needle of Fig. 6, and Fig. 8B is a bottom view of a sliding-resistance application plate and its surroundings in the compound needle.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] A compound needle for a flatbed knitting machine according to a preferred embodiment of the present invention will be described in detail below with reference to the drawings.

[0019] Fig. 1 is a side view of a compound needle according to a first embodiment of the present invention, as viewed in a direction in which needle grooves are arranged in parallel, and Fig. 2 is an exploded side view of the compound needle.

[0020] In the first embodiment, a plurality of compound needles 1 are arranged in parallel in a longitudinal direction of an unillustrated needle bed (a direction perpendicular to the paper plane of Fig. 1). Each of the compound needles 1 is received in a needle groove 10 (illustrated in Fig. 3B) in a state in which it can advance and retreat in a front-rear direction (a right-left direction in Fig. 1) with respect to a needle bed gap g to which yarn is supplied from an unillustrated yarn feeder. Each compound needle 1 includes a needle body 2 and a slider 3. By moving the needle body 2 and the slider 3 relative to each other in the front-rear direction, tongues 35 at a front end of the slider 3 open and close a hook 21 at a front end of the needle body 2, and the tongues 35 further move frontward beyond the hook 21. In the following description, in relation to components of the needle body 2 and the slider 3, a side close to the needle bed gap g is referred to as a front side, and an opposite side is referred to as a rear side.

[0021] The needle body 2 includes a hook member 22 having the hook 21 at its front end, and a needle jack 23. The slider 3 includes a slider base body 31, and two blades 32 and 33 of almost the same shape that are supported by the slider base body 31 and are superposed on each other.

[0022] The hook member 22 includes a slider groove 24 extending from a rear side of the hook 21. Front ends of the blades 32 and 33 are inserted and supported in the slider groove 24 in a manner such as to be able to slide in the front-rear direction. The hook member 22 also includes a support face 25 provided almost in the center in the front-rear direction, and the support face 25 slidably supports lower surfaces of a fixing portion 43 and a sliding contact portion 44 of the slider base body 31 that will be described below. The hook member 22 further includes a fitting recess 26 provided at its rear end. The hook

member 22 and the needle jack 23 are connected while a projection 231 projecting downward from a front end of the needle jack 23 is fitted in the fitting recess 26. The needle jack 23 also includes an arm 27 protruding rearward from the fitting recess 26 of the hook member 22. The arm 27 is curved downward such that a rear end thereof is in contact with the needle groove 10. From a portion of the needle jack 23 near the center in the front-rear direction, a branch arm 28 branches upward and extends frontward. Below the branch arm 28, a rear end of the slider base body 31 is supported such as not to fall off.

[0023] The blades 32 and 33 are superposed at a center position of the hook member 22 in a needle width direction, and each of the blades 32 and 33 has a tongue 35 at its front end.

[0024] Fig. 3A is an enlarged side view of the blades 32 and 33 and their surroundings in the compound needle 1, and Fig. 3B is a bottom view of a sliding-resistance application plate and its surroundings in the compound needle 1, as viewed from a needle bed side.

[0025] As illustrated in Figs. 3A and 3B, the slider 3 includes a sliding-resistance application plate 37. A front end of the sliding-resistance application plate 37 extends rearward integrally from a rear end of one of the blades 32 and 33 (the blade 33 on a front side of the paper plane of Fig. 3A). The sliding-resistance application plate 37 has a curved portion 371 curved in a substantially arc-shape such that a longitudinal center thereof is in sliding contact with a needle plate 11 on the other side in the needle width direction (an upper side in Fig. 3B) during movement of the slider 3. This sliding contact of the curved portion 371 applies a sliding resistance to the slider 3. The curved portion 371 is convex to the other side in the needle width direction. The slider 3 also includes an extending portion 38. A front end of the extending portion 38 extends rearward integrally from a rear end of the other blade (the blade 32 on a back side of the paper plane of Fig. 3A). The length of the extending portion 38 is set to be substantially equal to the length of the sliding-resistance application plate 37. On one side of the curved portion 371 of the sliding-resistance application plate 37 in the needle width direction (a lower side in Fig. 3B), a space 39 is defined by the curved portion 371 and the extending portion 38. In the following description, one side in the needle width direction is simply referred to as one side, and the other side in the needle width direction is simply referred to as the other side.

[0026] From a rear side of the slider groove 24, a guide groove 41 extends in the front-rear direction in the center of the support face 25 in the needle width direction. A projection 381 is provided integrally with a rear portion of the extending portion 38. The projection 381 is offset-bent in the center of the support face 25 in the needle width direction and projects into the guide groove 41. The projection 381 is slidably received in the guide groove 41.

[0027] The slider base body 31 includes a fixing portion 43 that fixes the rear ends of the blades 32 and 33 from one side in cooperation with the front ends of the sliding-resistance application plate 37 and the extending portion 38. The slider base body 31 also includes a sliding contact portion 44 with which the rear end of the sliding-resistance application plate 37 is in contact from one side with the rear end of the extending portion 38 being disposed therebetween. Further, the slider base body 31 includes a connecting portion 311 that extends in the front-rear direction above the curved portion 371 to connect the fixing portion 43 and the sliding contact portion 44. The connecting portion 311 is cut off on one side of the curved portion 371. This prevents bulging of the space 39 to the one side of the curved portion 371 due to dust accumulation from being hindered by the slider base body 31. Therefore, the space 39 is unlikely to bulge to the other side, the motion of the compound needle 1 is kept smooth, and an operation of removing dust from the space 39 can be delayed.

[0028] Moreover, since the fixing portion 43 and the sliding contact portion 44 are connected by the connecting portion 311 extending in the front-rear direction above the curved portion 371, the distance between the fixing portion 43 and the sliding contact portion 44 in the front-rear direction can be arbitrarily set in accordance with the length of the connecting portion 311. Thus, the length in the front-rear direction of the curved portion 371 of the sliding-resistance application plate 37 can be increased, and the sliding resistance of the curved portion 371 to the needle plate 11 can be set easily.

[0029] Between the curved portion 371 of the sliding-resistance application plate 37 on the lower side and the connecting portion 311 of the slider base body 31 on the upper side, a gap 40 extends in the front-rear direction. Thus, dust accumulated in the space 39 is easily discharged from the gap 40, and this is highly effective in delaying the operation of removing dust from the space 39.

[0030] The fixing portion 43 includes a groove 431 extending in the front-rear direction in the other side surface (a surface on the front side of the paper plane of Fig. 3A), and a substantially rectangular recess 432 extending upward from almost the center of the groove 431 in the front-rear direction. In the groove 431, the rear ends of the blades 32 and 33 are fitted. From the rear ends of the blades 32 and 33, projections 323 and 333 respectively project to be fitted in the recess 432. In a state in which the projections 323 and 333 are fitted in the recess 432, the rear ends of the blades 32 and 33 are fitted in the groove 431 of the fixing portion 43 and fixed to the fixing portion 43 by caulking together with the front ends of the sliding-resistance application plate 37 and the extending portion 38.

[0031] The sliding contact portion 44 includes a groove 441 provided in the other side surface thereof and extending in the front-rear direction. In the groove 441, the rear ends of the sliding-resistance application plate 37 and the extending portion 38 are fitted. Further, a bottom surface of the groove 441 is curved such that the groove

441 decreases in depth as it extends rearward beyond a sliding contact portion with the rear ends of the sliding-resistance application plate 37 and the extending portion 38.

[0032] A projection 29 projects upward from a rear end of the support face 25, and a recess 291 is provided in a front face of the projection 29. The sliding contact portion 44 has a projection 442 projecting rearward. When the slider 3 is placed at a withdrawal position in the slider groove 24 (a position of Fig. 1), the projection 442 of the sliding contact portion 44 is fitted in the recess 291, so that the slider 3 is supported so as not to fall upward from the needle body 2 while the rear end of the slider base body 31 is supported below the branch arm 28. Thus, the needle body 2 is restrained by the slider 3 at two front and rear positions, and the compound needle 1 can be smoothly removed from the needle groove 10.

[0033] A modification of the first embodiment will now be described with reference to Figs. 4A and 4B.

[0034] Fig. 4A is an enlarged side view of blades and their surroundings in a compound needle of the modification, and Fig. 4B is a bottom view of a sliding-resistance application plate and its surroundings in the compound needle. Since structures other than the sliding-resistance application plate and an extending portion are the same as those adopted in the first embodiment, only structures of the sliding-resistance application plate and the extending portion will be described.

[0035] That is, as illustrated in Figs. 4A and 4B, a slider 3 includes a sliding-resistance application plate 37. A front end of the sliding-resistance application plate 37 extends rearward integrally from a rear end of one of blades 32 and 33 (the blade 32 on a back side of the paper plane of Fig. 4A). The other blade (the blade 33 on a front side of the paper plane of Fig. 4A) is fixed at its rear end together with the blade 32 by caulking in a fixing portion 43. In this modification, an extending portion is not provided at the rear end of the other blade 33.

[0036] In this case, a space 39 on one side (a lower side in Fig. 4B) of a curved portion 371 of the sliding-resistance application plate 37 is not defined by the other blade 32 (extending portion), but is extended to a needle plate 11 on the one side. Further, dust accumulated in the space 39 easily moves in the front-rear direction between the sliding-resistance application plate 37 and the needle plate 11 in association with movement of the slider 3. For this reason, dust in the space 39 is easily discharged, and even when dust accumulates in the space 39, it is possible to play for sufficient time until the space 39 is filled with dust. Hence, an operation of removing dust from the space 39 can be delayed further.

[0037] The modification of the embodiment is not limited to the above modification, and the prevent invention also includes modifications illustrated in Figs. 5A to 5C.

[0038] Each of Figs. 5A to 5C is an enlarged side view of blades and their surroundings in a compound needle. In a modification illustrated in Fig. 5A, a sliding contact portion 44 has a substantially rectangular hole 443 that is provided through almost the center portion of the sliding contact portion 44 in the width direction and that extends long in the front-rear direction. Instead of the hole, a cutout substantially dented rearward may be provided at a front end of the sliding contact portion, or a cutout substantially dented upward may be provided at a lower edge of the sliding contact portion.

[0039] In a modification illustrated in Fig. 5B, a cutout 372 substantially dented frontward is provided at a rear end of a sliding-resistance application plate 37.

[0040] In a modification illustrated in Fig. 5C, a rectangular hole 373 is provided at each of front and rear ends of a sliding-resistance application plate 37.

[0041] In these modifications, even when dust accumulates in a space 39, the accumulated dust is easily discharged from the rear end of the sliding-resistance application plate 37 through the hole 443 or 373 or the cutout 372. This can further delay the operation of removing dust from the space 39.

[0042] Next, a second embodiment of the present invention will be described with reference to Figs. 6 to 8.

[0043] Fig. 6 is a side view of a compound needle for a flatbed knitting machine according to a second embodiment of the present invention. Fig. 7 is an exploded side view of the compound needle. Fig. 8A is an enlarged side view of blades and their surroundings in the compound needle, and Fig. 8B is a bottom view of a sliding-resistance application plate and its surroundings in the compound needle. Since structures other than a slider base body are the same as those adopted in the above-described first embodiment, a description will be given only of a structure of the slider base body.

[0044] That is, as illustrated in Figs. 6 to 8, a slider base body 51 includes a fixing portion 43 and a sliding contact portion 52. The slider base body 51 also includes a connecting portion 511 that connects the fixing portion 43 and the sliding contact portion 52. The connecting portion 511 extends in the front-rear direction below a curved portion 371 of a sliding-resistance application plate 37, and is cut off on one side (a lower side in Fig. 8B) of the curved portion 371. This prevents bulging of a space 39 to the one side of the curved portion 371 due to dust accumulation from being hindered by the slider base body 51. Therefore, the space 39 is unlikely to bulge to the other side, the motion of a compound needle 1 is kept smooth, and an operation of removing dust from the space 39 can be delayed.

[0045] Between the curved portion 371 of the sliding-resistance application plate 37 on the upper side and the connecting portion 511 of the slider base body 51 on the lower side, a gap 40 extends in the front-rear direction. The sliding contact portion 52 includes a stepped portion 521 dented from the other side surface toward one side surface.

[0046] In this case, a rear end of the sliding-resistance application plate 37 is in sliding contact with the stepped portion 521 of the sliding contact portion 52 with a rear end of an extending portion 38 being disposed therebe-

tween.

[0047] The present invention is not limited to the above-described embodiments and modifications, and includes other various modifications. For example, while the front end of the sliding-resistance application plate 37 integrally extends from the rear end of one of the blades, that is, the blade 33 and the front end of the extending portion 38 integrally extends from the rear end of the other blade 32 in the embodiments, front ends of a sliding-resistance application plate and an extending portion prepared separately from blades may be connected to rear ends of the blades. Alternatively, a front end of a sliding-resistance application plate prepared separately from one of the blades may be connected to a rear end of the blade in a state in which the front end of the sliding-resistance application plate and the rear end of the blade are superposed on each other.

[0048] While the fixing portion 43 is provided on the front side of the connecting portion 311 or 511 and the sliding contact portion 44 or 52 is provided on the rear side of the connecting portion 311 or 511 in the above-described embodiments and modifications, the fixing portion may be provided on the rear side of the connecting portion and the sliding contact portion may be provided on the front side, respectively, of the connecting portion.

Claims

1. A compound needle (1) for a flatbed knitting machine, comprising a needle body (2) and a slider (3) that are received in a needle groove (10) of a needle bed in the flatbed knitting machine and that move relative to each other in a front-rear direction,
wherein the slider (3) includes
a slider base body (31),
two blades (32, 33) that are supported by the slider base body (31), are slidably received in a slider groove (24) extending in the front-rear direction on a needle bed gap side of the needle body (2), and that extend rearward,
a sliding-resistance application plate (37) that extends integrally or separately from a rear end of at least one of the blades (32, 33) and applies a sliding resistance by sliding contact of a curved portion (371) curved in a substantially arc-form during movement of the slider (3),
a fixing portion (43) provided in the slider base body (31) to fix one of front and rear ends of the sliding-resistance application plate (37) from one side, and
a sliding contact portion (44) provided in the slider base body (31) such that the other end is in sliding contact with the sliding contact portion from the one side,
wherein the slider base body (31) further includes a connecting portion (311) that extends above or below the curved portion (371) to connect the fixing portion (43) and the sliding contact portion (44), and
wherein the connecting portion (311) is cut off on one side of the curved portion (371).

2. The compound needle (1) for the flatbed knitting machine according to Claim 1,
wherein the sliding-resistance application plate (37) extends from the rear end of only one of the blades (32, 33).

3. The compound needle (1) for the flatbed knitting machine according to Claim 1 or 2,
wherein a gap (40) is provided between the curved portion (371) of the sliding-resistance application plate (37) and the connecting portion (311) of the slider base body (31).

4. The compound needle (1) for the flatbed knitting machine according to any one of Claims 1 to 3,
wherein the sliding contact portion (44) or the sliding-resistance application plate (37) in sliding contact with the sliding contact portion (44) has a cutout or a hole.

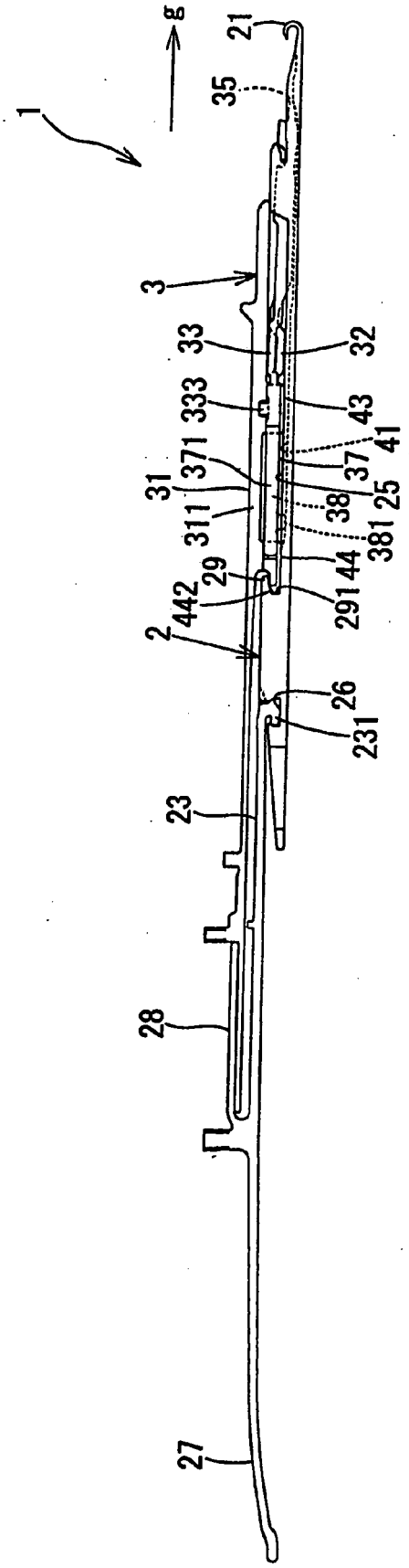
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Fig. 1

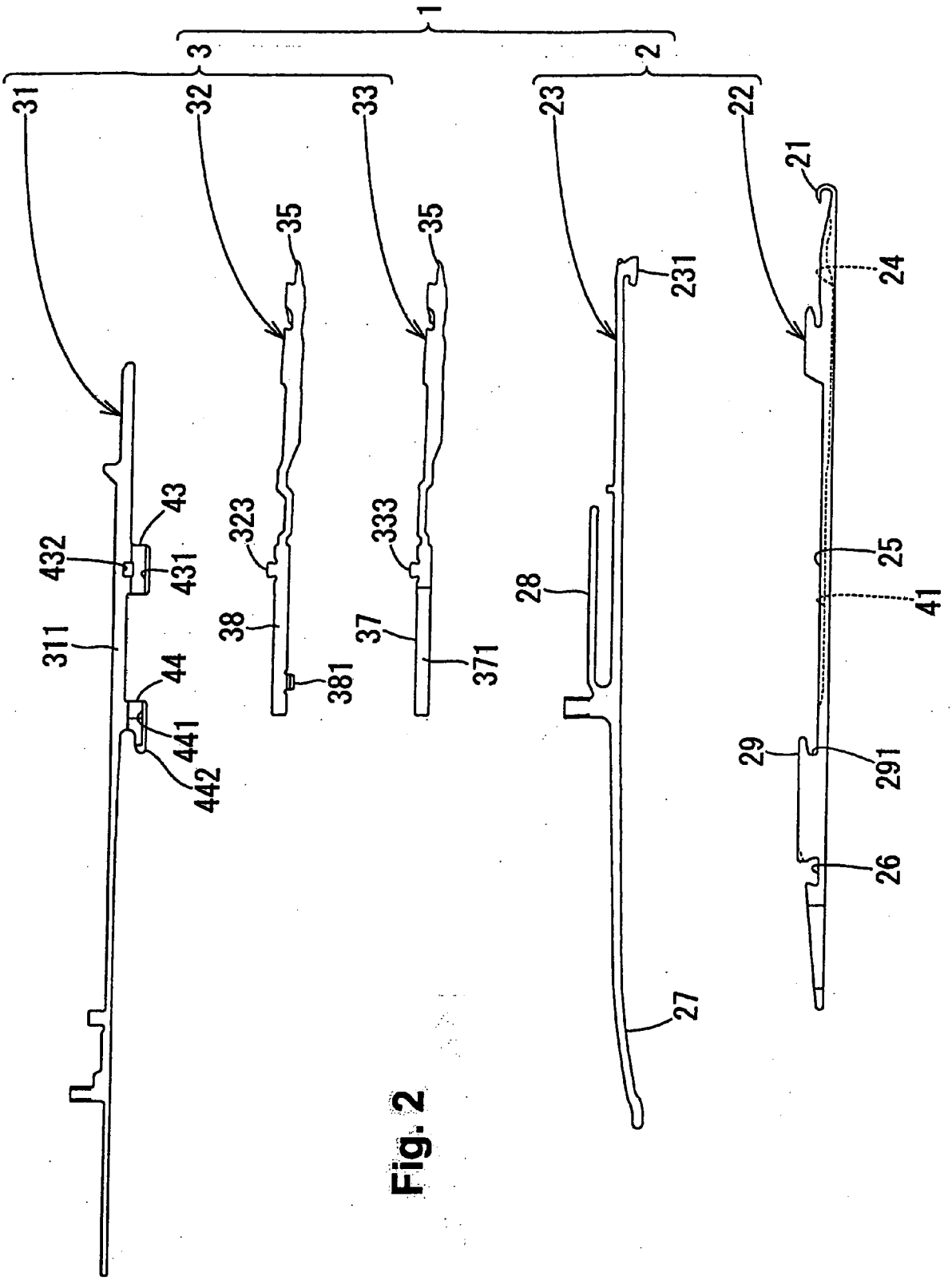
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Fig. 2

Fig. 3

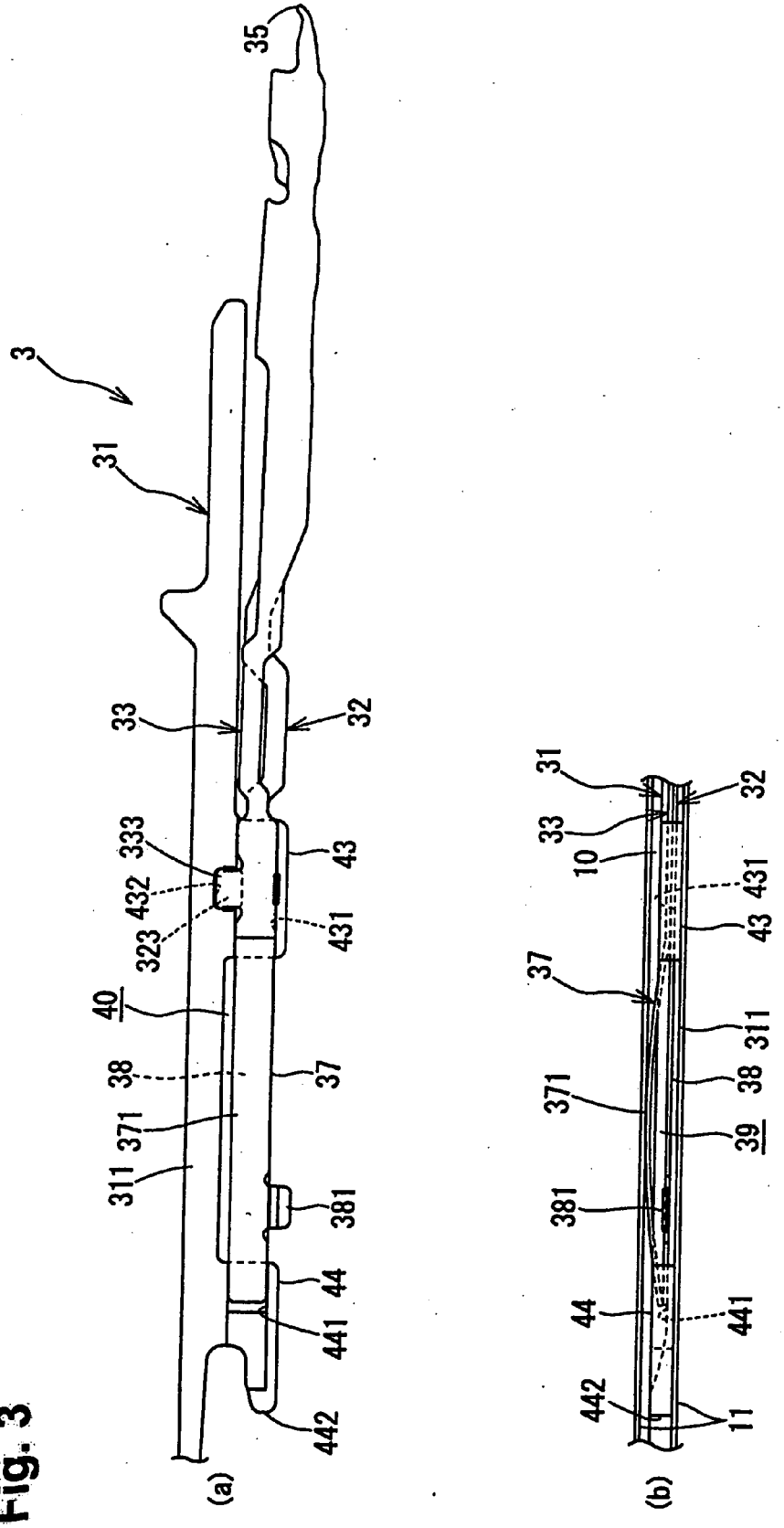
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Fig. 4

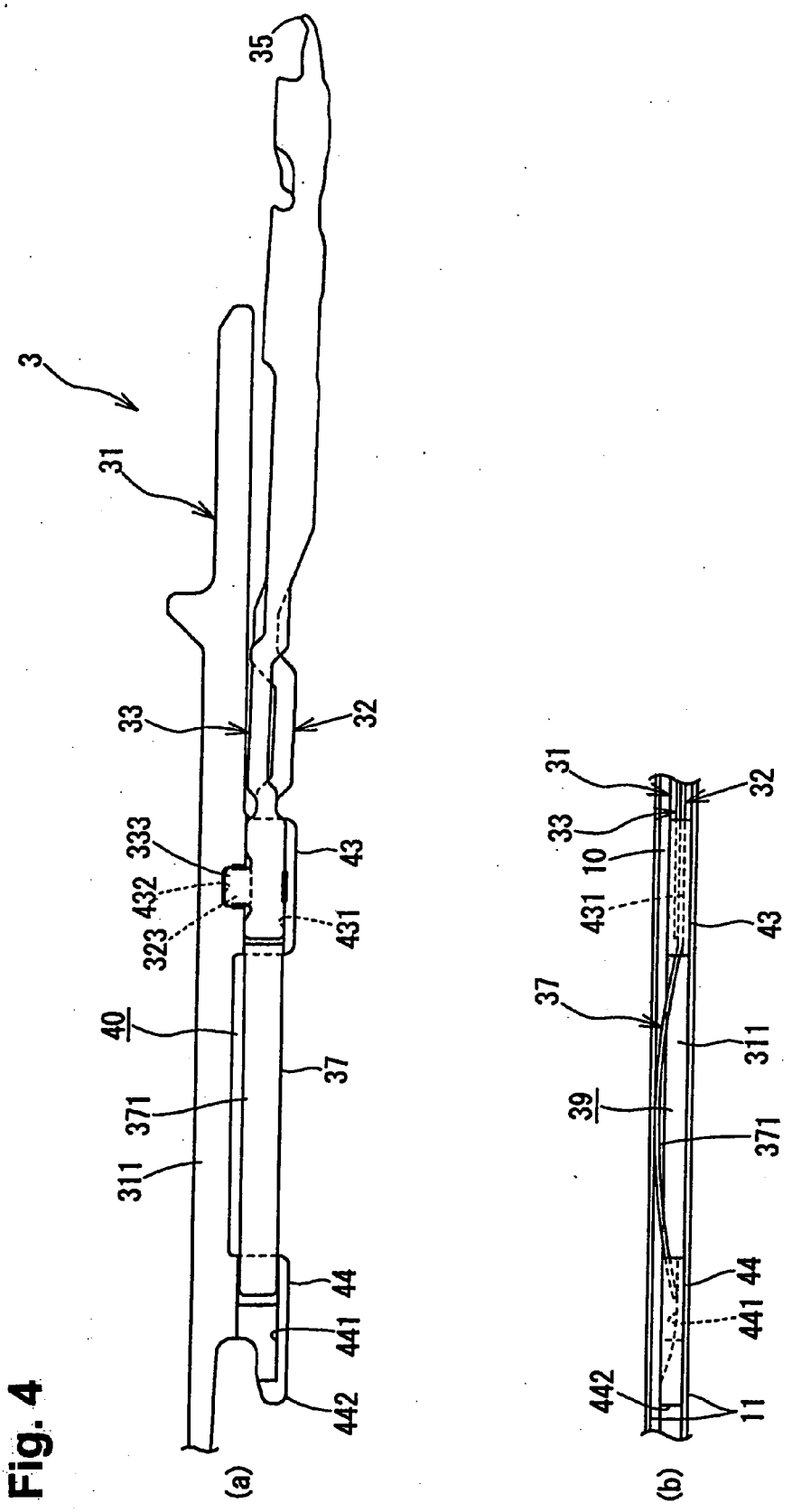
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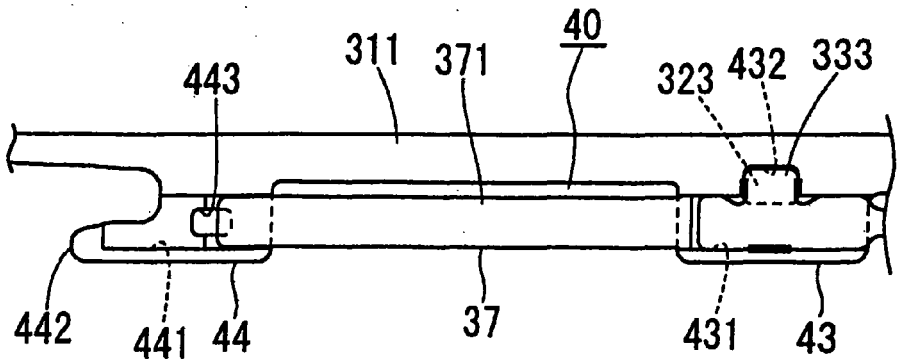
Fig. 5

(a)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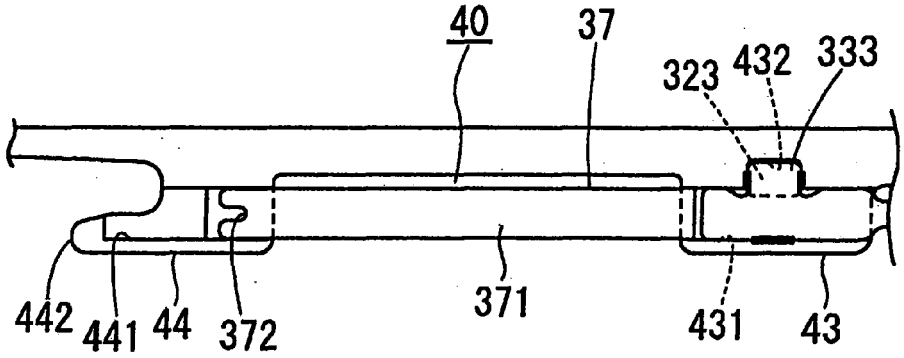
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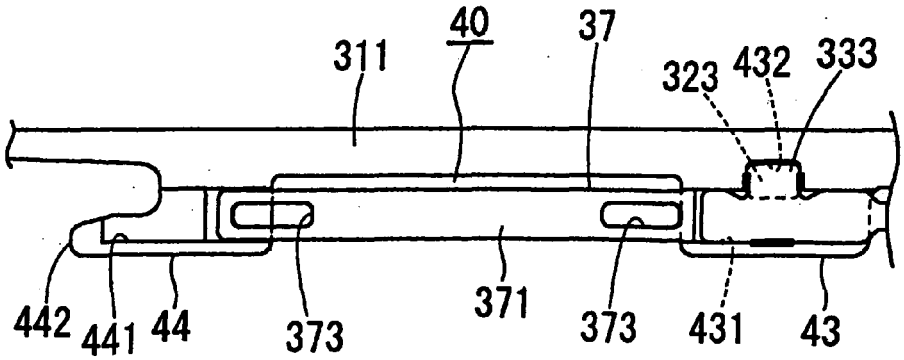
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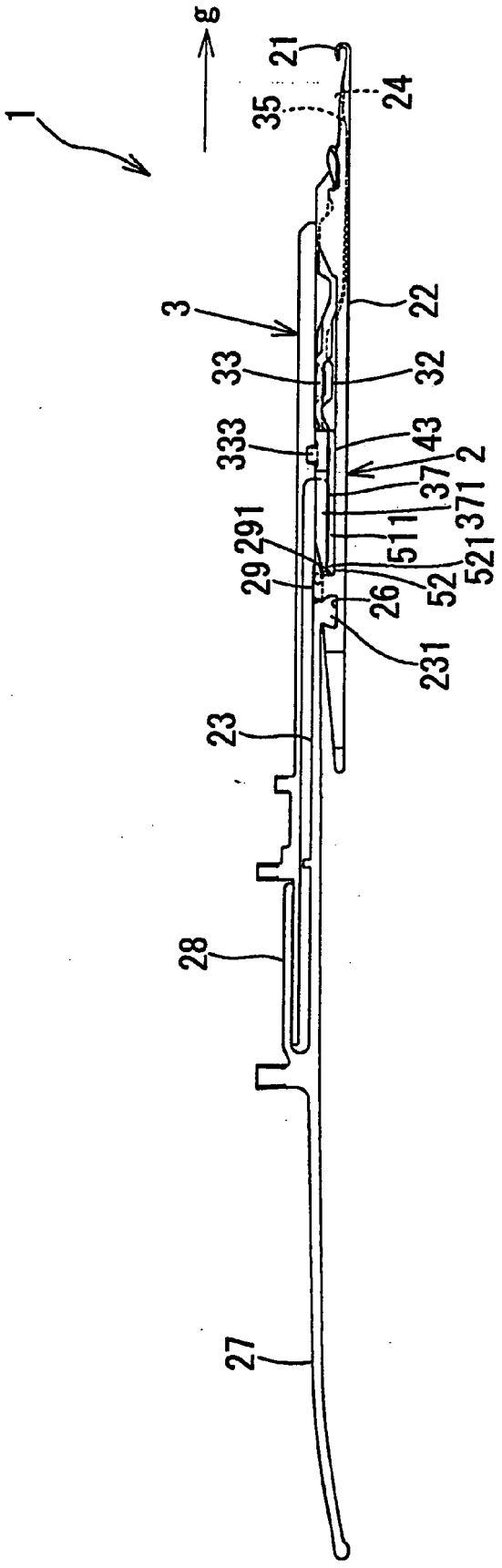
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Fig. 6

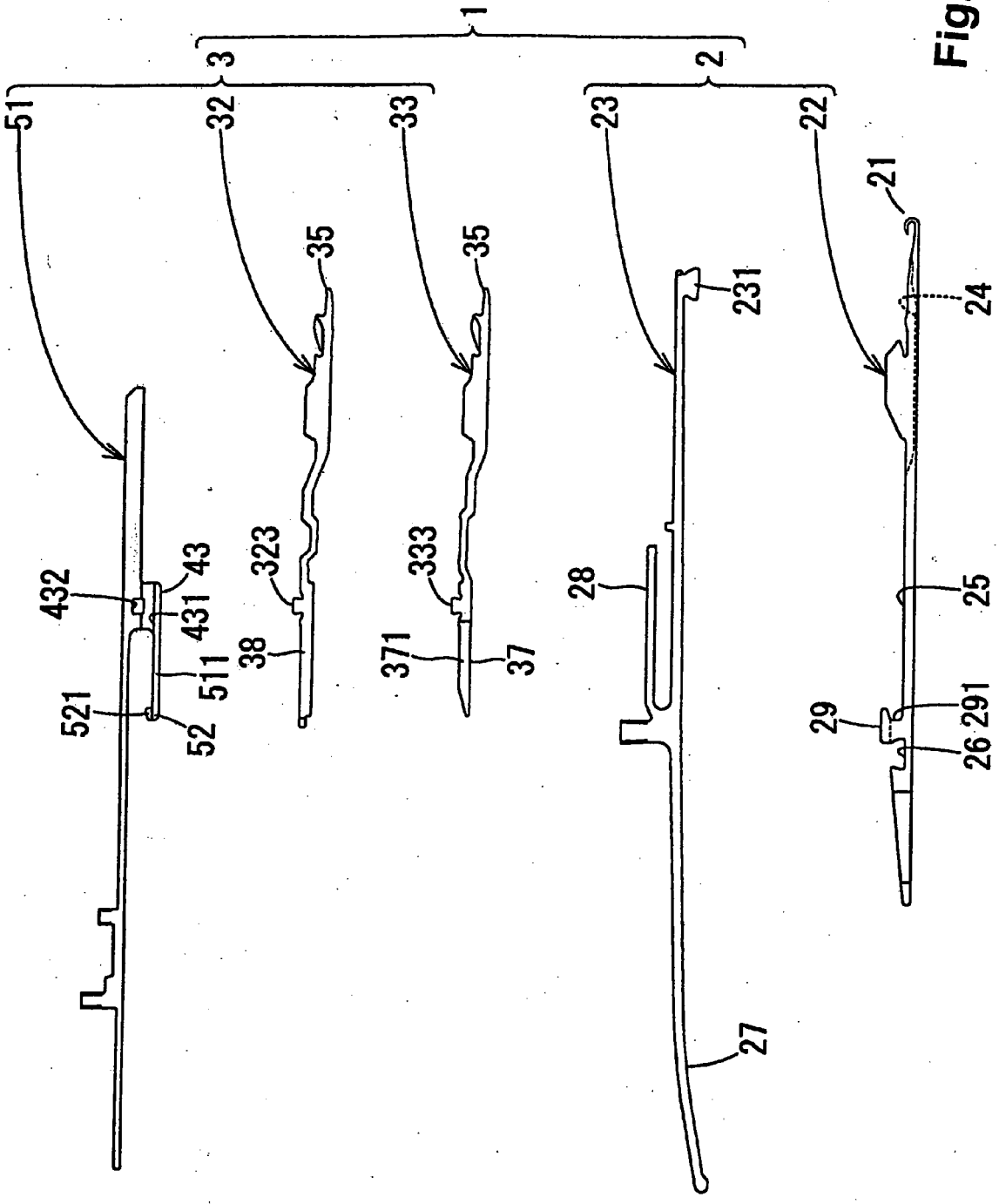
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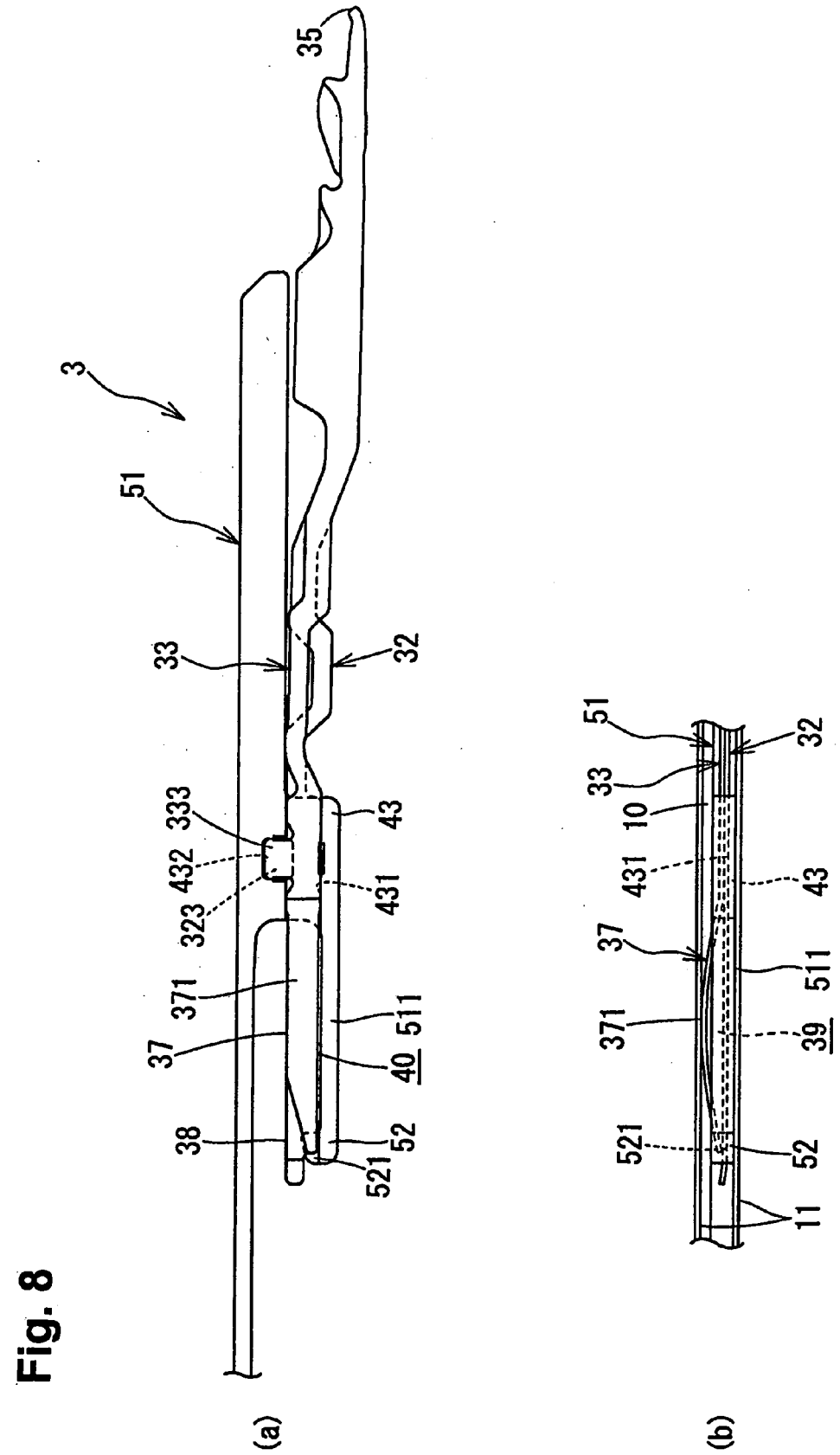
Fig. 7

Fig. 8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EUROPEAN SEARCH REPORT

Application Number
EP 12 00 7694

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D04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	5 February 2013	Wendl, Helen

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