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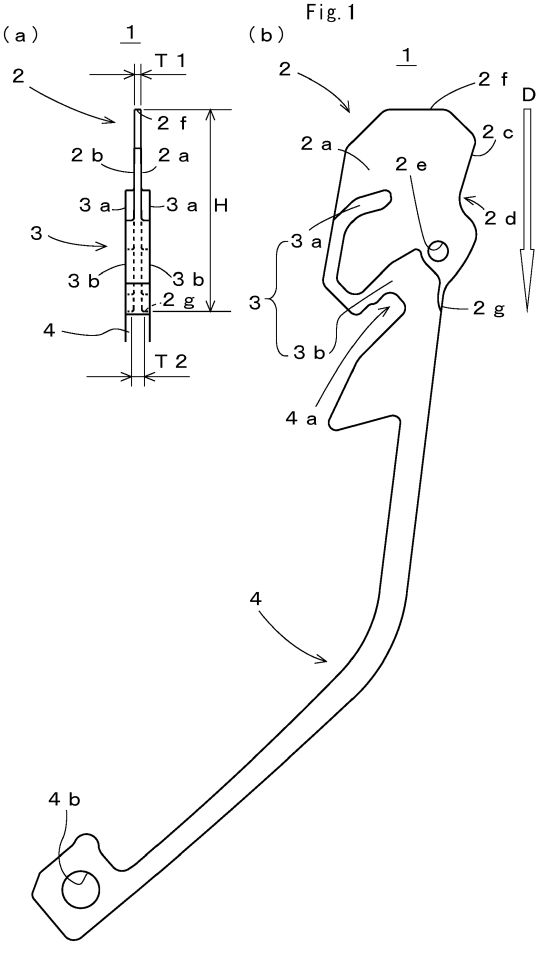
(54) FIXED SINKER AND FLATBED KNITTING MACHINE

(57) It is an object of the present invention to provide a fixed sinker and a flatbed knitting machine capable of making a collision between a fixed sinker and a knitting member less likely to occur.

A fixed sinker 1 includes a plate-like sinker body 2 that has a function of forming a sinker loop. At least one side surface 2a of the sinker body 2 has a slope of thickness such that the thickness increases along a transition direction from an upper start end 2f to a lower terminal end 2g. The other side surface 2b of the sinker body 2 has also a similar slope. With the slopes of thickness increase on the both side surfaces 2a, 2b, the sinker body 2 has a tapered shape as shown in a front view of (a). Since the sinker body 2 is thin at the upper start end 2f, even when a knitting member such as a loop presser enters from above opposing needle bed, it is possible to make a collision less likely to occur.

Fig. 1



EP 3 656 905 A1

Description

[Technical Field]

[0001] The present invention relates to a fixed sinker to be provided with at a leading end of a needle bed on a needle bed gap side in a flatbed knitting machine, and a flatbed knitting machine including such a fixed sinker.

[Background Art]

[0002] Conventionally, a flatbed knitting machine has knitting needles which are arranged in line at a constant pitch in a longitudinal direction of needle beds. The needle beds are arranged such that at least two of them face each other at front and back of a needle bed gap. Each of the knitting needles is accommodated in a needle groove formed on the needle bed and is driven such that a hook at a leading end of the knitting needle advances and retracts with respect to the needle bed gap. A plate-like sinker is arranged as an independent member between the knitting needles on the leading end side of the needle beds facing the needle bed gap. Each of the knitting needles is driven by advancing the hook at the leading end toward the needle bed gap, supplying a knitting yarn to the hook from above the needle bed gap, and then drawing the hook into the needle bed. The sinker is used to form a sinker loop together with a needle loop formed by the hook when the knitting needle is drawn into the needle bed, thereby to perform stitch determination to define the size of the stitch. The motionless fixed sinker attached to the needle bed gap side of the needle bed has a basic function of the stitch determination. Provided with a protrusion on the side surface, the fixed sinker can also perform an additional function of supporting the knitting needle under a lateral load (for example, refer to Patent Literature 1).

[0003] As another sinker having the stitch determination function, a movable sinker with an oscillating leading end part on the needle bed gap side can be used. The oscillating leading end part of the movable sinker has a function of pushing a formed stitch into below the needle bed gap. The movable sinker and the fixed sinker can be used in combination such that the fixed sinker performs stitch determination (for example, refer to Patent Literature 2). The fixed sinker can support a wire rod to be a verge in a hole near the leading end on the needle bed gap side to stabilize knock over of an old stitch loop when a new stitch loop is formed.

[0004] The flatbed knitting machine described in Patent Literature 2 is provided with a loop pressor which advances and retracts from an auxiliary bed above the back needle bed between the fixed sinker and the knitting needle on the front and back needle beds. The loop presser has a function of guiding a knitting yarn to the hook of the knitting needle and pressing a knitted stitch (for example, refer to Patent Literature 3).

[Citation List]

[Patent literatures]

[0005]

Patent Literature 1: JP 2006161230 A
Patent Literature 1: JP 2015132026 A
Patent Literature 1: WO 2003/018892 A

[Summary of Invention]

[Technical Problem]

[0006] As described in Patent Literature 3, the loop presser, which is provided above one needle bed, for example, the back needle bed, and is used in combination with the knitting needle and the fixed sinker provided on the both front and back needle beds, is considered as one of knitting members that enable formation of favorable stitches. Although the knitting member is considered to perform various functions, for the front needle bed, in particular, the knitting member needs to perform the function of advancing toward the needle bed gap from above the needle beds facing each other with the needle bed gap between them, moving downward from the needle bed gap, and reaching the side surface of the fixed sinker. Since a large number of knitting needles are disposed with narrow spacing therebetween on the needle beds, the knitting member needs to enter into the narrow gap between the fixed sinker in the middle between the knitting needles and the knitting needle When the knitting member enters into the gap between the fixed sinker and the knitting needle from above the needle beds facing each other, there is a possibility of a collision between the knitting member and the fixed sinker partially because of the influence of a positional shift between the front and back needle beds. If the knitting member and the fixed sinker collide with each other due to the advancement and retraction of the knitting member, the fixed sinker and the knitting member may become deformed or damaged.

[0007] It is desired for a flatbed knitting machine to arrange knitting needles with a finer pitch in order to knit a knitted fabric with fine stitches by using thin knitting yarns. As the pitch is finer, the spacing between the fixed sinker and the knitting needle into which the knitting member is to be entered becomes narrower as well. In addition, the permissible range of the positional shift between the front and back needle beds also becomes narrower to make it difficult to adjust the front and back positions of the needle beds facing each other. To avoid a collision between the knitting member and the fixed sinker, the knitting member and the fixed sinker might be made thinner. However, with a smaller thickness, the knitting member and the fixed sinker would become likely to bend, and thinner knitting yarns would easily get caught and cut on the knitting member and the fixed sinker.

[0008] An object of the present invention is to provide a fixed sinker and a flatbed knitting machine in which the fixed sinker and a knitting member are unlikely to collide with each other.

[Solution to Problem]

[0009] The present invention is a fixed sinker, provided with in a flatbed knitting machine which has at least one pair of needle beds facing each other with a needle bed gap between them, includes a plate-like sinker body which lines up between knitting needles aligned on the needle beds at a leading end on a needle bed gap side and has a function of forming a sinker loop,
characterized in that
at least one side surface of the sinker body has a slope of thickness such that thickness increases along a change direction predetermined to run from an upper start end to a lower terminal end in a state of being arranged on the needle bed.

[0010] In the present invention, said sinker body with said slope has a stitch determining part, on which a knitting yarn is to be put by said function of forming a sinker loop, at a front edge of said leading end side facing said needle bed gap under said start end as seen from said change direction.

[0011] In the present invention, said sinker body also has said slope of thickness on the other side surface as back side of said one side surface.

[0012] In the present invention, said sinker body has on both of said one side surface and said other side surface a supporting projection which projects toward a side surface of said knitting needle advancing with respect to said needle bed gap, and
said slope of thickness is provided to the both side surfaces except for the supporting projection.

[0013] Further the present invention is a flatbed knitting machine provided with:

a fixed sinker according to any of claims 1 to 4;
at least a pair of needle beds facing each other with a needle bed gap between them; and
a knitting member which advances and retracts with respect to the needle bed gap and vertically moves in the needle bed gap,

characterized in that

the plate-like sinker body of the fixed sinker is arranged at the leading end of at least one of the needle beds on the needle bed gap side, and
the knitting member is provided above at least the other needle bed.

[Advantageous Effects of Invention]

[0014] According to the present invention, the fixed sinker includes the plate-like sinker body. The sinker body is arranged at the leading end of the needle bed on the needle bed gap side in the flatbed knitting machine, and is increased in thickness on at least one side surface along the change direction from the upper start end to the lower terminal end. The knitting member advancing from the opposing needle bed toward the needle bed gap moves downward in the gap between the one side surface of the sinker body and the hook of the adjacent knitting needle along the thickness change direction of the one side surface. The sinker body is thinner at the upper start end where the downward movement to the gap for the knitting member is started than at the lower terminal end, which makes the collision less likely to occur. The thickness of the sinker body increases with the slope toward the terminal end along the change direction, which makes the sinker body less prone to bend as compared to the case in which the entire sinker body has the thinness of the start end.

[0015] Further according to the present invention, even if the upper start end is made thin, the stitch determination part on which the sinker loop is to be put is positioned under the start end at the time of stitch formation, and therefore the front edge of the sinker body can be formed such that the part on which the knitting yarn is to be put does not become thin.

[0016] Further according to the present invention, the other side surface of the plate-like sinker body is thin at the upper start end and is thick at the lower terminal end along the change direction. Thus, when the sinker is arranged on the both needle beds facing each other in the front-back direction and is used as a common component, the slope of the thickness can be effectively used. On the needle bed side above which the knitting member is provided, the start end of the other side surface by which the knitting member advancing toward the needle bed gap and moving downward passes is thinner to make the knitting member and the sinker body less likely to collide with each other. In the case of using the movable sinker in common on the both needle beds as well, the side surface on which the movable sinker oscillates is set on the back side of the side surface by which the knitting member passes, thereby to increase the gap between the knitting member and the thinner start end and make the interference less likely to occur.

[0017] Further according to the present invention, in the case of arranging the sinker body of the fixed sinker on the needle bed with respect to which the knitting member advances and retracts from the opposing needle be, the sinker body can enter the knitting member into the lateral side along the slope of the one side surface that increases in thickness until the leading end of the knitting member reaches the supporting projection. The supporting projection can support the lateral side of the knitting needle advancing and retracting on the one side surface so as not to approach too much the entered knitting member.

[0018] Further according to the present invention, it is possible to obtain a flatbed knitting machine in which the

sinker body of the fixed sinker is arranged at the leading end of at least one of the needle beds on the needle bed gap side, and when the knitting member provided above the other opposing needle bed advances and retracts with respect to the needle bed gap and vertically moves in the needle bed gap, the knitting member and the sinker body are unlikely to collide with each other.

[Brief Description of Drawings]

[0019]

[Fig. 1] Fig. 1 is a partial front view of a configuration of a fixed sinker 1 as an example of the present invention and an overall right view of the same.
[Fig. 2] Fig. 2 is a partial right cross-sectional view of a flatbed knitting machine 10 to which the fixed sinker 1 shown in Fig. 1 is attached.
[Fig. 3] Fig. 3 is a partial right cross-sectional view of the flatbed knitting machine 10 shown in Fig. 2, and shows operations of a loop presser 20 in the flatbed knitting machine 10.
[Fig. 4] Fig. 4 is a schematic planar view of the flatbed knitting machine 10 shown in Fig. 2, and shows layout of the fixed sinker 1 and the loop presser 20.

[Description of Embodiments]

[0020] Hereinafter, a schematic configuration of a fixed sinker 1 as an example of the present invention will be described with reference to Fig. 1 to Fig. 4. For the convenience of description, some components are not shown in the drawing as a description target but might be referred by using reference numerals shown in other drawings in some cases..

[Example]

[0021] Fig. 1 shows a configuration of the fixed sinker 1 as an example of the present invention. Fig. 1(a) is a front view of a sinker body 2 which performs a function to form a sinker loop and the like in the fixed sinker 1, and Fig. 1(b) is an overall right side view of the fixed sinker 1 in a posture to be attached to a needle bed. The sinker body 2 has a plate-like shape and is attached to a leading end of a needle bed on a needle bed gap side in a flatbed knitting machine, and has a function to form a sinker loop. One side surface 2a of the sinker body 2 has a slope such that the thickness increases along a change direction D which is predetermined to run from an upper start end 2f to a lower terminal end 2g in a state to be arranged on the needle bed. The other side surface 2b of the sinker body 2 on the back side of the one side surface 2a has the same slope. In the present example, the both side surfaces 2a, 2b of the sinker body 2 have the slopes with increase of thickness in a symmetrical form, so that the sinker body 2 has a tapered shape as shown in the front view of Fig. 1(a).

[0022] In the fixed sinker 1, parts other than the sinker body 2 are thicker than the sinker body 2, and constitute a supporting projection 3 and an attaching arm 4. While the fixed sinker 1 is attached to the needle bed, when the knitting needle advancing toward the needle bed gap might be about to bend under a lateral load, the supporting projection 3 could hit and support the side surface of the knitting needle to block lateral warping. In the present example, the fixed sinker 1 is used in a flatbed knitting machine having two-stage upper and lower needle beds, and the supporting projection 3 includes an upper-stage part 3a and a lower-stage part 3b. The supporting projection 3 is located on a side of the sinker body 2, which is separated from the needle bed gap when the fixed sinker 1 is attached to the needle bed, A needle bed gap side of the sinker body 2 constitutes a front edge 2c, and a concave portion near the vertical center of the front edge 2c constitutes a stitch determining part 2d. There is provided a through-hole 2e near the middle between the stitch determining part 2d and the terminal end 2g. The through-hole 2e can support a wire to constitute a verge. The lower side of the sinker body 2 and the supporting projection 3 continues to the attaching arm 4. The attaching arm 4 has a hanging concavity 4a on the upper end side and a through-hole 4b on the lower end side.

[0023] As shown in Fig. 1(a), the thickness of the sinker body 2 is T1 at the upper start end 2f and T2 at the lower terminal end 2g distant from the start end 2f by a height H. The direction from the start end 2f to the terminal end 2g constitutes the change direction D shown in Fig. 1(b). The change direction D relates to an entering direction of the knitting member, and the entering direction will be described later with reference to Fig. 3.

[0024] When the fixed sinker 1 is manufactured, a metal plate with a thickness necessary for the attaching arm 4 is used as a raw material and is received some process such that the thickness of the sinker body 2 is decreased and the thickness of the supporting projection 3 is not decreased but remained. Such process can be implemented by mechanical cutting or grinding. The slopes with thickness increase can be provided such that the one side surface 2a and the other side surface 2b are asymmetrical with difference in angle, or the angle is changed in the middle, a curved surface is formed, or the slope is formed only on the one side surface 2a.

[0025] Thickness of the sinker body 2 is about one-quarter of the thickness of the metal plate before processing. As the metal plate, a steel plate with a thickness of about 1 mm can be used, for example. The metal plate is tapered such that the thickness T1 at the start end 2f is about 0.26 mm and the thickness T2 at the terminal end 2g is about 0.30 mm, for example. The height H is about 8 mm, for example. In this case, the thickness increases 0.04 mm along the height of 8 mm, thereby obtaining a slope of 0.5%. Decreasing the thickness T1 at the start end 2f makes it less likely to cause a collision with the knitting member entering from the opposing needle bed. Even when the thickness T1 is decreased, the

stitch determining part 2d in the middle between the start end 2f and the terminal end 2g is located under the start end 2f and is thicker than T1. When the thickness T2 of the terminal end 2g is not decreased too much, the stitch determining part 2s on which the knitting yarn is to be put can be saved from becoming too thin. However, if the upper start end 2f becomes sharp with a decrease in the thickness T1, the knitting yarn might contact the start end 2f in the needle bed gap and might become damaged. The thicknesses T1 and T2 can be decided as appropriate according to the thickness of the metal plate as a raw material, the degree to which the knitting member enters and overlaps, and the like.

[0026] Fig. 2 simplistically shows a partial configuration of the flatbed knitting machine 10 to which the fixed sinkers 1 shown in Fig. 1 are attached. The fixed sinkers 1 are attached such that the sinker bodies 2 are fitted to leading end sides of base plates 11a, 12a of the front needle bed 11 and the back needle bed 12, opposed to each other. Although each of needle beds 11, 12 is provided in two-stage form, the upper-stage needle beds are omitted to show in the drawing. The fixed sinkers 1 are attached by inserting the attaching arms 4 into grooves at the leading ends of the base plates 11a, 12a. Hanging wires 13 are inserted into between hanging concavities 4a of the attaching arms 4 and the base plates 11a, 12a. The wires passing through grooves in the base plates 11a, 12a penetrate the lower through-holes 4b not shown. The fixed sinkers 1, attached to the front needle bed 11 and the back needle bed 12 which face each other, oppose each other with the needle bed gap 14 formed between the front needle bed 11 and the back needle bed 12.

[0027] The front needle bed 11 and the back needle bed 12 are basically configured in the same manner including the upper stage needle beds which are omitted to be shown, and are provided with knitting needles 15 in the each of the two-stage needle beds. Each of the knitting needles 15 is a compound needle of which the hook 15a at the leading end advances and retracts with respect to the needle bed gap 14 and is opened and closed by a slider 15b. In addition to the fixed sinkers 1, movable sinkers 16 are used as well. At the time of stitch formation, verge wires 17 supported by the through-holes 2e in the sinker bodies 2 of the fixed sinkers 1 are used to stabilize knock-over.

[0028] On each of the needle beds 11, 12, needle plates are aligned on the side separated from the needle bed gap 14 with respect to the sinker bodies 2 of the fixed sinkers 1 aligned on the needle bed gap 14 side such that needle grooves for accommodating the knitting needles 15 are formed between the needle plates. The needle plates could also be extended to the needle bed gap 14 side to form the sinker body 2 at the leading ends. In the case of providing the needle beds 11, 12 in two-stage each, the needle bed in the upper stage is located above an extension of the needle plate of the lower stage needle bed. The needle plate of the upper stage needle bed in the back needle bed 12 is extended upward to support an auxiliary bed which accommodates loop pressers 20. A leading end part 21 of the loop presser 20 can enter from above the back needle bed 12 into the fixed sinker 1 attached to the front needle bed 11 in such a manner as to overlap the fixed sinker 1 on the one side surface 2a side of the sinker body 2. The loop presser 20 shown by a solid line is in a standby state above the back needle bed 12. The loop presser 20 is driven by a cam mechanism mounted on a carriage, which is omitted to show in the drawing, as disclosed in Patent Literature 3, for example, and advances above from the back needle bed 12 side to the vicinity of center of the needle bed gap 14, and approaches the sinker body 2 of the fixed sinker 1 as shown by a two-dot chain line.

[0029] Fig. 3 shows operations of the loop presser 20 related to the change direction D shown in Fig. 1(b) for the flatbed knitting machine 10 shown in Fig. 2. The leading end part 21 shown by a two-dot chain line in Fig. 2 further advances, and then moves downward as shown by a solid line in a gap between the one side surface 2a of the sinker body 2 and the hook 15a of the knitting needle 15 at a position where to hang over the sinker body 2 of the fixed sinker 1 on the front needle bed 11. Therefore, the direction of entering into an overlapping area between the sinker body 2 and the leading end part 21 of the loop presser 20 corresponds to the vertical change direction D shown in Fig. 1(b). Since the thickness of the sinker body 2 is smaller at the upper start end 2f where the loop presser 20 starts to advance into the overlapping area than at the lower terminal end 2f, it is possible to reduce the risk of mechanical interference and make a collision less prone to occur. In the sinker body 2, providing a slope of thickness to the other side surface 2b as the back side of the one side surface 2a makes it possible to, in the case of providing the movable sinker 16 in the gap between the side surface 2b and the hook 15a of the knitting needle 15, increase the gap and make the interference less prone to occur. In addition, in the case of attaching the fixed sinker 1 to the back needle bed 12, it is possible to ensure the sufficient gap by using the slope of thickness of the other side surface 2b by which the loop presser 20 passes.

[0030] Fig. 4 schematically shows a layout of the fixed sinkers 1 and the loop pressers 20 in the flatbed knitting machine 10 shown in Fig. 2. Figs. 2, 3 correspond to the cross sections of the fixed sinkers 1 and the knitting needles 15 as seen from a position where the knitting needles 15 are located on the front side and the fixed sinkers 1 are located on the back side. Each of the leading end parts 21 of the loop pressers 20 advances and retracts between the fixed sinker 1 and the knitting needle 15, and each of the movable sinkers 16 is arranged between the fixed sinker 1 and the knitting needle 15. Each of the leading end parts 21 of the loop pressers 20 enters into a gap S between the one side surface 2a of the sinker body 2a and the hook 15a of the knitting needle 15 on the front needle bed 11, and enters into between the other

side surface 2b and the hook 15a on the back needle bed 12. The movable sinkers 16 are arranged on the other side surface 2b side of the sinker body 2 on the front needle bed 11 and arranged on the one surface 2a side of the sinker body 2 on the back needle bed 12, and the leading end parts of the movable sinkers 16 oscillate in the needle bed gaps 14. The side surfaces 2a, 2b of the sinker bodies 2 decrease in thickness on the lateral sides of the oscillating leading end parts, thereby making it possible to ensure the gap and reduce interference at the time of oscillation.

[0031] The supporting projections 3 are provided on the both side surfaces 2a, 2b of the sinker bodies 2 to project toward the side surfaces of the knitting needles 15 advancing into the needle bed gaps 14. Each of the loop pressers 20 can be laterally entered along the slope of the one side surface 2a where the thickness increases until the leading end part 21 reaches the supporting projection 3. Each of the supporting projections 3 can laterally support the knitting needle 15 advancing and retracting on the one side surface 2a side such that the knitting needle 15 does not approach too much closer to the leading end part 21 of the loop presser 20. The slope of thickness is provided to the both side surfaces 2a, 2b of the sinker body 2 except for the supporting projections 3, so that the slopes can be effectively provided to a degree that the leading end part 21 is capable of entering.

[0032] In the present example, the front needle bed 11 and the back needle bed 12 are provided upper and lower in two-stage form, but both the needle beds may be provided in one-stage or either of the needle beds may be provided in one-stage. To make a collision less prone to occur between the loop presser 20 entering from above the opposing needle bed and the start end 2f of the sinker body 2, a slope of increasing thickness is provided to only the one side surface 2a side where the loop presser 20 is to enter. Since the thickness continuously increases due to the slope, there occurs no discontinuous step that would be generated by increasing the thickness stepwise, which makes it possible to smoothly guide and enter the loop presser 20 even with a contact between the sinker body 2 and the loop presser 20.

[0033] The advantageous effects of providing the slope of thickness described above can be favorably obtained not only in a case where the loop presser 20 enters from the auxiliary bed provided above only one of the front and back needle beds sandwiching the needle bed gap 14 between them but also in a case where the loop presser 20 enters from above the both needle beds. These advantageous effects can also be obtained in a case where a knitting member other than the loop presser 20 contributing to the knitting of the knitted fabric enters. For example, the action of pressing the stitch downward by the movable sinker 16 in the present example may be performed by that knitting member instead. In addition, some knitting member having new functions can be additionally provided.

[Explanation of Reference]

[0034]

1	Fixed sinker
2	Sinker body
2a	One side surface
2b	Other side surface
2c	Front edge
2d	Stitch determining part
3	Supporting projection
10	Flatbed knitting machine
11	Front needle bed
12	Back needle bed
14	Needle bed gap
15	Knitting needle
15a	Hook
16	Movable sinker
20	Loop presser
21	Leading end part

Claims

1. A fixed sinker (1), provided with in a flatbed knitting machine (10) which has at least one pair of needle beds (11, 12) facing each other with a needle bed gap (14) between them, includes a plate-like sinker body (2) which lines up between knitting needles (15) aligned on the needle beds (11, 12) at a leading end on a needle bed gap (14) side and has a function of forming a sinker loop,
characterized in that
at least one side surface (2a) of the sinker body (2) has a slope of thickness such that thickness increases along a change direction (D) predetermined to run from an upper start end (2f) to a lower terminal end (2g) in a state of being arranged on the needle bed (11, 12).

2. The fixed sinker (1) according to claim 1,
wherein said sinker body (2) with said slope has a stitch determining part (2d), on which a knitting yarn is to be put by said function of forming a sinker loop, at a front edge (2c) of said leading end side facing said needle bed gap (14) under said start end (2f) as seen from said change direction (D).

3. The fixed sinker (1) according to claim 1 or 2,
wherein said sinker body (2) also has said slope of thickness on the other side surface (2b) as back side of said one side surface (2a).

4. The fixed sinker (1) according to claim 3,
wherein said sinker body (2) has on both of said one side surface (2a) and said other side surface (2b) a supporting projection (3) which projects toward a side surface of said knitting needle (15) advancing

with respect to said needle bed gap (14), and said slope of thickness is provided to the both side surfaces (2a, 2b) except for the supporting projection (3).

5. A flatbed knitting machine (10) provided with:

a fixed sinker (1) according to any of claims 1 to 4;
at least a pair of needle beds (11, 12) facing each other with a needle bed gap (14) between them; and
a knitting member (20) which advances and retracts with respect to the needle bed gap (14) and vertically moves in the needle bed gap (14),

characterized in that

the plate-like sinker body (2) of the fixed sinker (1) is arranged at the leading end of at least one of the needle beds (11) on the needle bed gap (14) side, and
the knitting member (20) is provided above at least the other needle bed (12).

Fig. 1

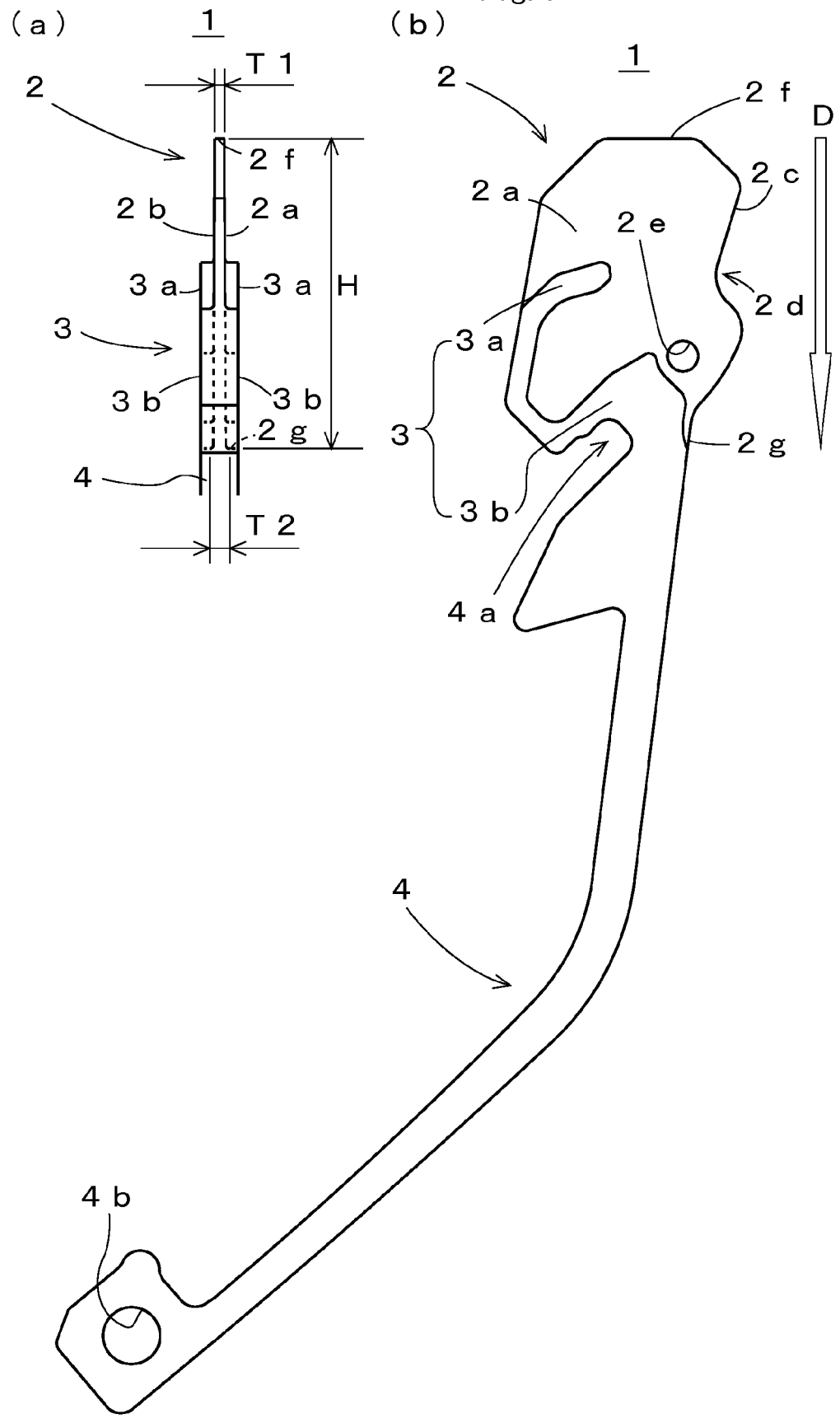

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Fig. 2

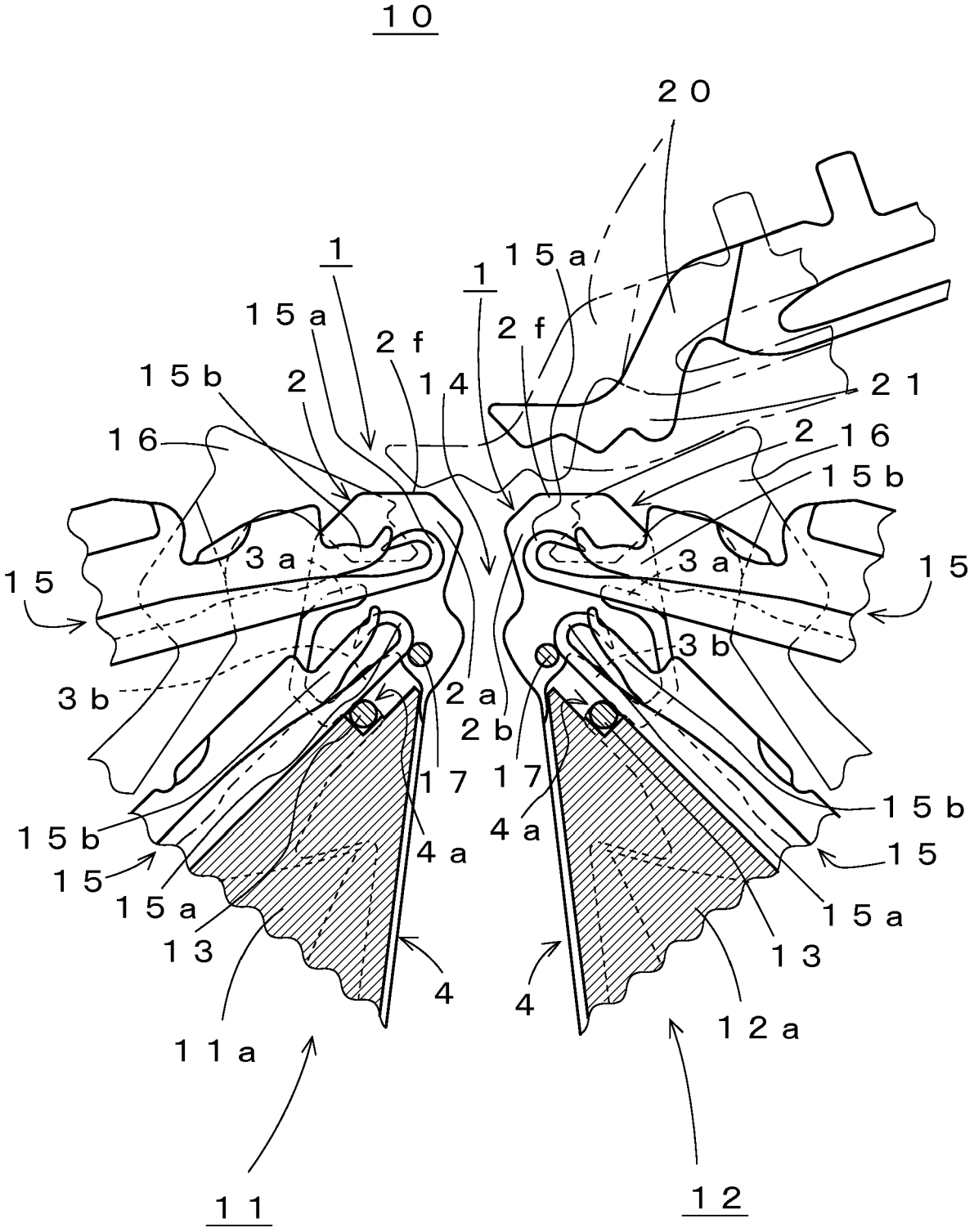
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Fig. 3

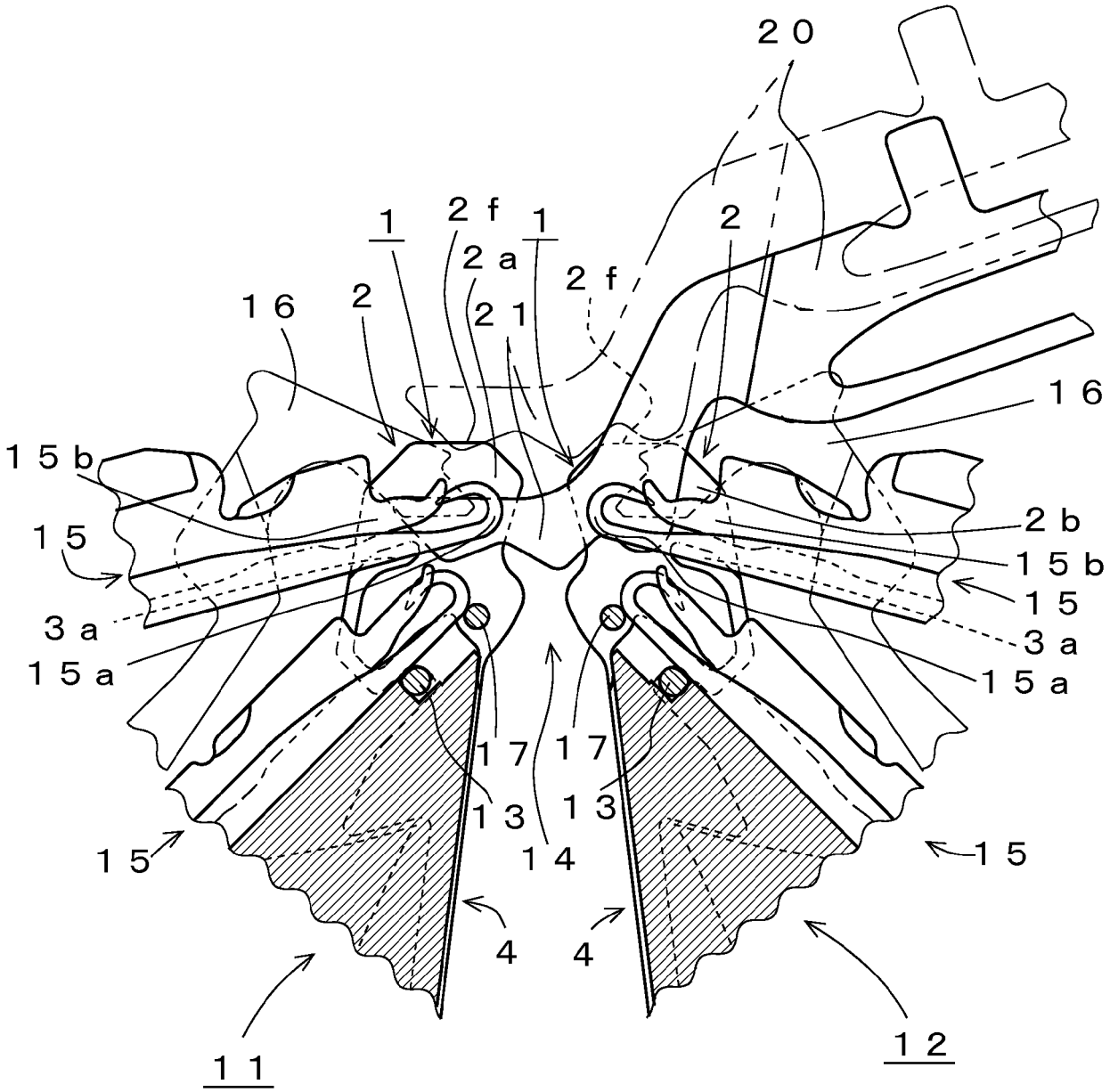
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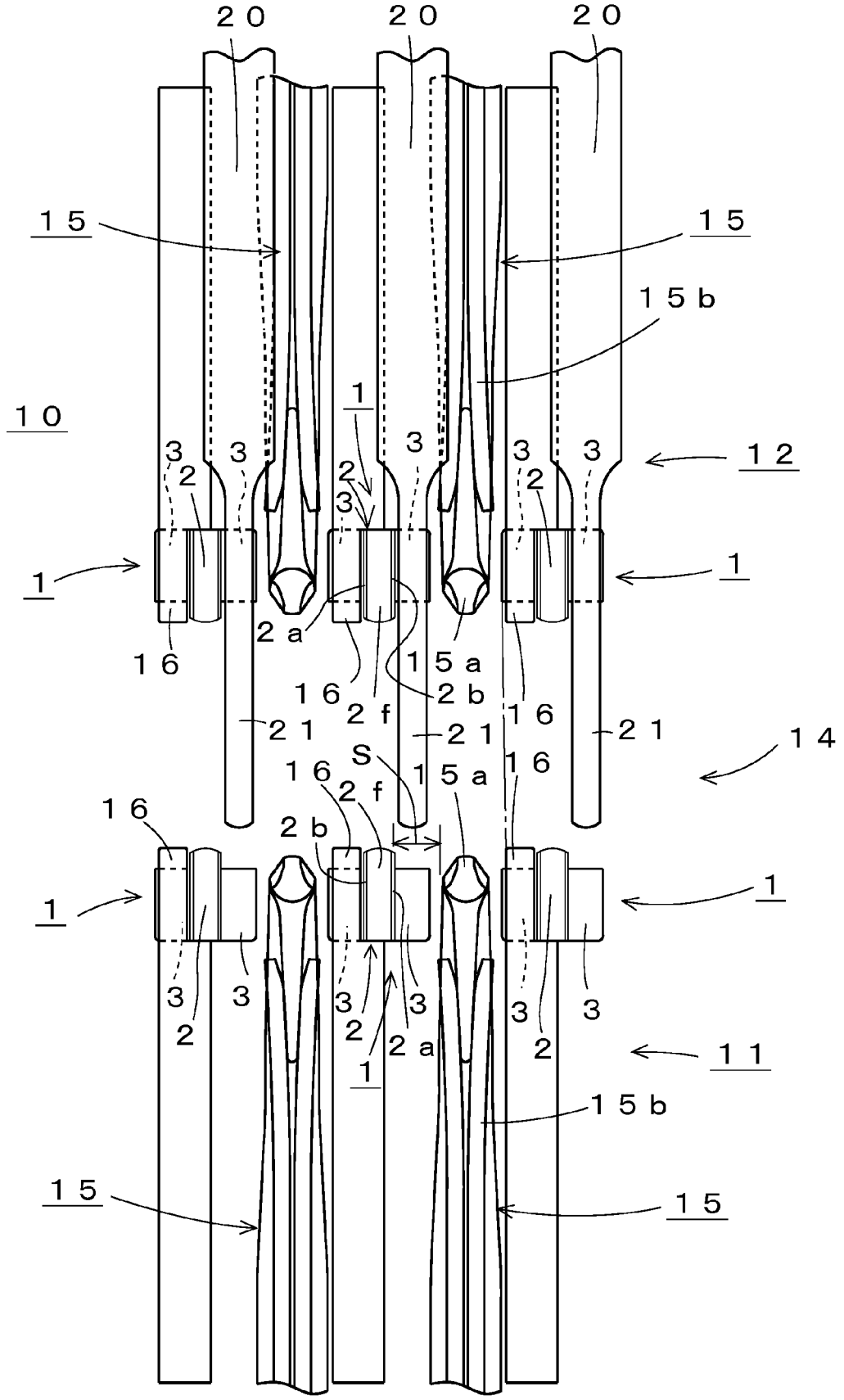
Fig. 4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EUROPEAN SEARCH REPORT

Application Number
EP 19 20 9010

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Munich	3 April 2020	Kirner, Katharina

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