(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 865 444 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
18.08.2021 Bulletin 2021/33

(21) Application number: **21155182.5**

(22) Date of filing: **04.02.2021**

(51) Int Cl.:
B65H 71/00 *(2006.01)* ***D01D 5/096*** *(2006.01)*
D06B 1/08 *(2006.01)* ***D06B 3/04*** *(2006.01)*

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **12.02.2020 JP 2020021400**

(71) Applicant: **TMT Machinery, Inc.**
Osaka-shi, Osaka 541-0041 (JP)

(72) Inventors:
- **Toyoda, Kai**
  Kyoto-shi, Kyoto 612-8686 (JP)
- **Hashimoto, Kinzo**
  Kyoto-shi, Kyoto 612-8686 (JP)
- **Kawamoto, Kazuhiro**
  Kyoto-shi, Kyoto 612-8686 (JP)

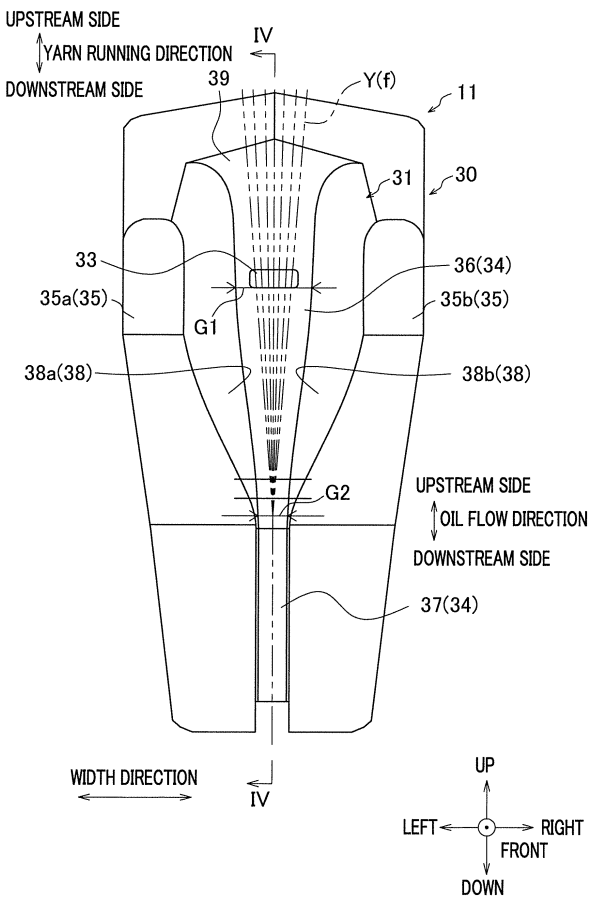
(74) Representative: **Hoffmann Eitle**
Patent- und Rechtsanwälte PartmbB
Arabellastraße 30
81925 München (DE)

(54) OIL APPLYING GUIDE AND SPUN YARN TAKE-UP MACHINE

(57) An object of the present invention is to suppress an unintentional accumulation of oil not adhering to a yarn in an oil applying guide.

An oil applying guide 11 which applies oil to a yarn Y running downward from above includes a guide main body 30 in which a passage 31 which allows the oil to flow downward from above is formed. The passage 31 includes a yarn contact surface 36 with which the yarn Y makes contact, the yarn Y leaving the yarn contact surface 36 at a downstream end portion of the yarn contact surface 36 in an oil flow direction in which the oil flows, an oil discharging surface 37 which allows the oil to be discharged, which is provided downstream of the yarn contact surface 36 in the oil flow direction, and which is formed so that a direction between the oil discharging surface 37 and a yarn path 101 increases toward a downstream side in the oil flow direction, and paired regulating surfaces 38 formed on both ends, in a width direction of the passage 31, of the passage 31. Regarding a distance between the pared regulating surfaces 38 in the width direction, the distance which is between shortest points of parts formed on both sides, in the width direction, of the yarn contact surface 36 is 0.35 mm or less.

FIG.3



EP 3 865 444 A1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to an oil applying guide configured to apply oil to a yarn and a spun yarn take-up machine including the oil applying guide.

[0002] Patent Literature 1 (Japanese Laid-Open Patent Publication No. 2002-309432) discloses (see FIG. 3 of Patent Literature 1) an oil applying guide configured to apply oil to a running yarn in the step of spinning out synthetic fibers. In the oil applying guide, a passage is formed so as to allow the oil discharged from an oil discharge hole to flow downward. The passage includes a yarn contact surface which extends substantially vertically and with which the yarn makes contact, an oil discharging surface which is provided below the yarn contact surface and which extends obliquely rearward and downward, and regulating surfaces which are formed on both sides, in a width direction of the passage, of the yarn contact surface and the oil discharging surface and which regulate the movement of the yarn so as to prevent the yarn from moving out of the passage in the width direction of the passage. The yarn in contact with the yarn contact surface leaves the yarn contact surface at the downstream end portion of the yarn contact surface in an oil flow direction. The oil discharged from the oil discharge hole flows in the passage, and adheres to the running yarn in contact with the yarn contact surface. Among the oil flowing in the passage, a part of the oil does not adhere to the yarn, and is scattered from the oil applying guide or dropped down along the oil discharging surface and discharged (collected).

SUMMARY OF THE INVENTION

[0003] Recently, the present inventors have found that oil not adhering to a yarn tends to be disadvantageously scattered or dropped down depending on the thickness of the yarn or the density of the oil. As a result of an earnest examination by the present inventors, it has been found that the scattering of the oil, etc., occurs due to the cause as follows. That is, in the vicinity of the yarn immediately after leaving the yarn contact surface, when the oil is unintentionally accumulated in the passage (e.g., in the space surrounded by an oil discharging surface and regulating surfaces), the accumulated oil is scattered from the passage by being dragged by the yarn going out from the oil applying guide. Because of this, the scattering of the oil, etc., occurs.

[0004] An object of the present invention is to suppress an unintentional accumulation of oil not adhering to a yarn in an oil applying guide.

[0005] A first aspect of the invention provides an oil applying guide which applies oil to a yarn running downward from above, the oil applying guide comprising a guide main body in which a passage allowing the oil to flow downward from above is formed, and the passage including: a yarn contact surface with which the yarn makes contact, the yarn leaving the yarn contact surface at a downstream end portion of the yarn contact surface in an oil flow direction in which the oil flows; an oil discharging surface which allows the oil to be discharged, which is provided downstream of the yarn contact surface in the oil flow direction, and which is formed so that a distance between the oil discharging surface and a yarn path increases toward a downstream side in the oil flow direction; and paired regulating surfaces formed at both ends, in a width direction of the passage, of the passage, and on the yarn contact surface, the minimum distance in the width direction between the paired regulating surfaces being 0.35 mm or less.

[0006] Typically, the oil applying guide is provided so that the yarn contact surface is positioned on the upper side and the oil discharging surface is positioned on the lower side. The oil supplied to the oil applying guide provided as above flows downward from above, along the yarn contact surface and the oil discharging surface. As described above, in the vicinity of the yarn after leaving the yarn contact surface, when the oil is unintentionally accumulated in the passage, the accumulated oil may be, e.g., scattered from the passage by being dragged by the yarn. Especially, the oil flowing at both end portions of the passage in the width direction is likely to flow toward the downstream side in the oil flow direction without making contact with the yarn (i.e., without adhering to the yarn), with the result that the oil is highly likely to be accumulated in the space. When an amount of the oil not adhering to the yarn is large, the oil is dropped down from the oil discharging surface and then discharged (collected).

[0007] In the present invention, regarding the distance between the pared regulating surfaces in the width direction, the distance which is between the shortest points of the parts formed on the both sides, in the width direction, of the yarn contact surface is 0.35 mm or less. Because of this, the oil flowing through the part of the passage, which is narrow in width, easily makes contact with the yarn (i.e., easily adheres to the yarn). It is therefore possible to decrease an amount of the oil flowing toward the downstream side in the oil flow direction without adhering to the yarn, and with the result that the accumulation of the oil is suppressed in the space. Therefore, in the oil applying guide, it is possible to suppress the unintentional accumulation of the oil not adhering to the yarn.

[0008] A second aspect of the invention provides an oil applying guide which applies oil to a yarn running downward from above, the oil applying guide comprising a guide main body in which a passage allowing the oil to flow downward from above is formed, and the passage including: a yarn contact surface with which the yarn makes contact, the yarn leaving the yarn contact surface at a downstream end portion of the yarn contact surface in an oil flow direction in which the oil flows; an oil discharging surface which allows the oil to be discharged,

which is provided downstream of the yarn contact surface in the oil flow direction, and which is formed so that a distance between the oil discharging surface and a yarn path increases toward a downstream side in the oil flow direction; and paired regulating surfaces formed at both ends, in a width direction of the passage, of the passage, the paired regulating surfaces being formed on both sides, in the width direction, of the yarn contact surface, and not being formed on both sides, in the width direction, of at least an upstream end portion of the oil discharging surface in the oil flow direction.

[0009] In the present invention, in the oil flow direction, a part in which the regulating surfaces are not formed is provided immediately downstream of a position (hereinafter, it is referred to as a leaving position) where the yarn leaves the yarn contact surface. Because of this, on the downstream side of the leaving point in the oil flow direction, the space in which the oil may be accumulated is small. Therefore, also in the present invention, it is possible to suppress the unintentional accumulation of the oil not adhering to the yarn in the oil applying guide.

[0010] According to a third aspect of the invention, the oil applying guide of the first or second aspect is arranged such that the minimum distance in the width direction between the regulating surfaces formed on the both sides of the yarn contact surface is the shortest at a position where the yarn leaves the yarn contact surface.

[0011] In the present invention, because the distance at the above-described leaving point and its surroundings is short, the space in which the oil may be accumulated is small. Therefore, the scattering of the oil, etc., is further suppressed.

[0012] According to a fourth aspect of the invention, the oil applying guide of any one of the first to third aspects is arranged such that, in a cross section cut along a direction orthogonal to the width direction, an angle formed between a yarn path extending from a point where the yarn leaves the yarn contact surface toward a downstream side in a yarn running direction and an upstream end portion, in the oil flow direction, of the oil discharging surface is 50 degrees or more.

[0013] When the angle is small, the oil may tend to be accumulated due to increase of the influence of surface tension in the space formed between the yarn immediately after leaving the yarn contact surface and the oil discharging surface. In the present invention, because the angle is 50 degrees or more, the influence of surface tension is decreased. Therefore, the accumulation of the oil is suppressed in the space formed between the yarn and the oil discharging surface.

[0014] According to a fifth aspect of the invention, the oil applying guide of any one of the first to fourth aspects is arranged such that, when the guide main body is provided so that the yarn running downward from above makes contact with the yarn contact surface, an angle formed between the oil discharging surface and the vertical line is within a range of 60 to 72 degrees in the cross section cut along a direction orthogonal to the width direction.

[0015] In the present invention, because the angle formed between the oil discharging surface and the vertical line is arranged within the range of 60 to 72 degrees, it is possible to achieve both the suppression of the accumulation of the oil in the space formed between the yarn and the oil discharging surface and, by means of the gravity, the smooth discharge of the oil along the oil discharging surface.

[0016] According to a sixth aspect of the invention, the oil applying guide of the first or second aspect is arranged such that the oil discharging surface includes: a first discharging surface provided downstream of the yarn contact surface in the oil flow direction; and a second discharging surface which is provided downstream of the first discharging surface in the oil flow direction and which is bent with respect to the first discharging surface, and when the guide main body is provided so that the yarn running downward from above makes contact with the yarn contact surface, as compared to a first angle formed between the first discharging surface and the vertical line, a second angle formed between the second discharging surface and the vertical line being small in the cross section cut along a direction orthogonal to the width direction, in particular smaller than the above mentioned first angle.

[0017] As the fourth aspect of the invention described above, for example, the accumulation of the oil is suppressed in the space formed between the yarn and the oil discharging surface by increasing the angle formed between the yarn path and the upstream end portion, in the oil flow direction, of the oil discharging surface. Meanwhile, when the angle formed between the oil discharging surface and the vertical line is increased by increasing the angle described above, the direction of the oil discharging surface is arranged to be close to the horizontal direction. Therefore, the discharging efficiency of the oil by means of the gravity may be decreased (especially, when the flowing of the oil starts before the yarn runs, the discharging efficiency of the oil is further decreased). To be more specific, when it becomes difficult to discharge the oil from the downstream part of the oil discharging surface in the oil flow direction, the oil may tend to be accumulated also at the upstream part of the oil discharging surface. In this regard, in the present invention, because the second angle can be decreased even when the first angle is increased. It is therefore possible to suppress the decrease of the discharging efficiency of the oil.

[0018] According to a seventh aspect of the invention, the oil applying guide of the sixth aspect is arranged such that the second angle is 50 degrees or less.

[0019] In the present invention, because the second angle is 50 degrees or less, the decrease of the discharging efficiency of the oil is further reliably suppressed.

[0020] An eighth aspect of the present invention provides a spun yarn take-up machine comprising: a spinning apparatus configured to spin out a yarn; a take-up apparatus configured to take up the yarn spun out from

the spinning apparatus and to wind the yarn onto a bobbin; and the oil applying guide according to any one of the first to seventh aspects, which is provided between the spinning apparatus and the take-up apparatus in the yarn running direction.

[0021] Because the yarn is typically spun out at high speed from the spinning apparatus, the oil which is unintentionally accumulated in the oil applying guide is highly likely to be, e.g., scattered by being dragged by the yarn running at high speed. It is especially effective to apply the oil applying guide to the spun yarn take-up machine structured in this way, so as to suppress the unintentional accumulation of the oil not adhering to the yarn.

[0022] According to a ninth aspect of the invention, the spun yarn take-up machine of the eighth aspect is arranged such that the spinning apparatus is configured to be able to spin out yarns each of which is 55 decitex or less in thickness.

[0023] When the oil is applied to the thin yarn, among the oil flowing through the passage, the oil flowing at the both end portions of the passage in the width direction tends to flow toward the downstream side in the oil flow direction without making contact with the yarn (i.e., without adhering to the yarn). Because of this, an amount of the oil unintentionally accumulated may be increased in the oil applying guide. It is especially effective to apply the oil applying guide to the spun yarn take-up machine structured in this way, so as to suppress the unintentional accumulation of the oil not adhering to the yarn.

[0024] According to a tenth aspect of the invention, the spun yarn take-up machine of the eighth or ninth aspect further includes an oiling device configured to be able to supply oil in which the concentration is 85 and or more to the oil applying guide.

[0025] Typically, a high density oil is unlikely to adhere to the yarn (e.g., the oil is unlikely to go into the gaps between the filaments in one yarn made of plural filaments) due to the high kinematic viscosity. Because of this, an amount of the oil flowing toward the downstream side in the oil flow direction without adhering to the yarn is increased. It is especially effective to apply the oil applying guide to the spun yarn take-up machine structured in this way, so as to suppress the unintentional accumulation of the oil not adhering to the yarn.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026]

FIG. 1 is a side view of a spun yarn take-up machine of a first embodiment.

FIG. 2 is a schematic diagram of an oil applicator.

FIG. 3 is a front view of an oil applying guide of the first embodiment.

FIG. 4 is a cross section taken along a line IV-IV in FIG. 3.

FIG. 5 shows effect test results regarding the first embodiment.

FIG. 6 is a front view of an oil applying guide of a second embodiment.

FIG. 7(a) is a cross section taken along a line VII-VII in FIG. 6, and FIG. 7(b) is an enlarged view of a part of FIG. 7(a).

FIG. 8 shows effect test results regarding the second embodiment.

FIG. 9 is a cross section of an oil applying guide related to a modification of the second embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

<First Embodiment>

[0027] The following will describe a first embodiment of the present invention. Hereinafter, directions shown in FIG. 1 and FIG. 2 will be consistently used as an up-down direction, a left-right direction, and a front-rear direction, for convenience of explanation. The up-down direction is a vertical direction in which the gravity acts. The front-rear direction is a direction which is orthogonal to the up-down direction and in which later-described bobbins B are aligned. The left-right direction is a direction orthogonal to both the up-down direction and the front-rear direction. Moreover, a direction in which a yarn Y runs is referred to as a yarn running direction.

(Spun Yarn Take-Up Machine)

[0028] The following will outline a spun yarn take-up machine 1 of the first embodiment, with reference to FIG. 1 and FIG. 2. FIG. 1 is a side view of a spun yarn take-up machine 1 of the first embodiment. FIG. 2 is a schematic diagram of an oil applicator 3 described later. As shown in FIG. 1, the spun yarn take-up machine 1 includes a spinning apparatus 2, the oil applicator 3, a drawing device 4, and a take-up apparatus 5.

[0029] The spinning apparatus 2 is configured to spin out yarns Y made of synthetic fibers (e.g., polyester) from the respective spinnerets 2a aligned in, e.g., the left-right direction through discharge ports (not illustrated). For one example, the spinning apparatus 2 is able to spin out twelve yarns Y as shown in FIG. 1. Each yarn Y is, e.g., a multi-filament yarn made of plural filaments f. However, the disclosure is not limited to this. The yarn Y may be made of one filament f. The spinning apparatus 2 is able to change the thickness of the yarns Y (filaments f) which are spun out, in accordance with an aperture area of each discharge port of the spinneret 2a. For one example, the spinning apparatus 2 is able to spin out thin yarns Y each of which is 55 decitex or less in thickness. Below the spinning apparatus 2, an unillustrated cooling apparatus is provided for cooling the yarns Y immediately after being spun out from the spinning apparatus 2.

[0030] The oil applicator 3 includes oil applying guides 11 which are provided to correspond to the yarns Y running downward from above and an oiling device 12 (see FIG. 2) which supplies oil to the oil applying guides 11.

For example, the oil applicator 3 is configured to (see an arrow pointing left in FIG. 2) supply oil to each oil applying guide 11 through a supply pipe 13 from the oiling device 12. The oil passes through the supply pipe 13 so as to be supplied to the oil applying guide 11, and then the oil makes contact with and adheres to the yarn Y. For example, a part of the oil, which does not adhere to the yarn Y, passes through (see an arrow pointing rightward and downward in FIG. 2) a collection passage 14 provided below the oil applying guide 11, so as to be collected by a collection box 15.

[0031] The oil applying guides 11 are provided below the spinning apparatus 2 and the cooling apparatus (not illustrated) so as to correspond to the yarns Y. The oil applying guides 11 are provided between the cooling apparatus and the take-up apparatus 5 (i.e., between the spinning apparatus 2 and the take-up apparatus 5) in the yarn running direction. Each oil applying guide 11 is configured to cause filaments f spun out from the spinneret 2a to be one yarn Y while applying the oil supplied from the oiling device 12 to the yarn Y. The details of the oil applying guide 11 will be given later. As the oil, the oiling device 12 is able to supply, e.g., a mixture (emulsion) of water and oil. The oiling device 12 is able to supply oil of various densities. For example, the oiling device 12 is able to supply oil of high density, i.e., 85 % or more in mass percentage.

[0032] The drawing device 4 is provided below the oil applicator 3. The drawing device 4 includes a heat retaining box 16 and heating rollers 16a housed in the heat retaining box 16. By the heating rollers 16a, the drawing device 4 draws the yarns Y while heating them. The water which is included in oil applied to the yarn Y is evaporated in such a way that, e.g., the heating rollers 16a heat the yarn Y, so as to be removed from the oil.

[0033] The take-up apparatus 5 is configured to take up yarns Y spun out from the spinning apparatus 2 and to wind the yarns Y onto the bobbins B, so as to form packages P. As shown in FIG. 1 and FIG. 2, the take-up apparatus 5 includes a first godet roller 17 and a second godet roller 18 which are configured to take up the yarns Y and a winding unit 19 configured to wind the taken-up yarns Y onto the bobbins B. The winding unit 19 includes fulcrum guides 21, traverse guides 22, a turret 23, two bobbin holders 24, and a contact roller 25.

[0034] Each of the fulcrum guides 21 is a guide about which the yarn Y is traversed by each traverse guide 22. The fulcrum guides 21 are provided for the respective yarns Y, and are aligned in the front-rear direction. The traverse guides 22 are provided for the respective yarns Y, and are aligned in the front-rear direction. Each of the traverse guides 22 is driven by an unillustrated motor, and traverses the yarn Y in the front-rear direction.

[0035] The turret 23 is a disc-shaped member having an axis substantially parallel to the front-rear direction. The turret 23 is rotationally driven by an unillustrated turret motor. The two bobbin holders 24 have axes in parallel to the front-rear direction, respectively, and are rotatably supported at an upper end portion and a lower end portion of the turret 23. To each bobbin holder 24, bobbins B provided for the respective yarns Y are attached to be lined up in the front-rear direction. Each of the two bobbin holders 24 is rotationally driven by an individual motor (not illustrated). The contact roller 25 is configured to make contact with the surfaces of the packages P supported by the upper bobbin holder 24. With this, the contact roller 25 applies a contact pressure to the surfaces of the unfinished packages P, to adjust the shape of each package P.

[0036] In the winding unit 19 described above, when the upper bobbin holder 24 is rotationally driven, the yarns Y traversed by the traverse guides 22 are wound onto the bobbins B, with the result that the packages P are formed. When the formation of the packages P is completed, the turret 23 is rotated to switch over the upper and lower positions of the two bobbin holders 24. As a result, the bobbin holder 24 having been at the lower position is moved to the upper position, which allows the yarns Y to be wound onto the bobbins B attached to the bobbin holder 24 having been moved to the upper position, to form packages P.

(Oil Applying Guide)

[0037] The structure of the oil applying guide 11 will be described with reference to FIG. 3 and FIG. 4. FIG. 3 is a front view of the oil applying guide 11. FIG. 4 is a cross section taken along a line IV-IV in FIG. 3. Hereinafter, a direction in which oil flows is referred to as an oil flow direction. Furthermore, the width direction of a passage 31 (described later), which is substantially parallel to the left-right direction, is simply referred to as a width direction.

[0038] The oil applying guide 11 includes a guide main body 30 in which the passage 31 allowing the oil to flow is formed. The guide main body 30 is made of a ceramic material such as alumina or zirconia. However, the disclosure is not limited to this.

[0039] The passage 31 extends at least in the up-down direction, and allows the oil to flow downward from above. A part of the passage 31 functions as a passage for guiding the yarn Y downward from above. As shown in FIG. 3 and FIG. 4, the passage 31 includes a supply hole 32, a discharge port 33, a flow surface 34, paired regulating walls 35 (regulating walls 35a and 35b).

[0040] The supply hole 32 is a hole which is formed at the rear part of the guide main body 30 and which extends in the front-rear direction. The supply hole 32 is formed so that the supply pipe 13 described above is inserted from behind the suction hole 32. The discharge port 33 is formed at an intermediate portion of the guide main body 30 in the front-rear direction and at the front end of the supply hole 32. The discharge port 33 is formed at the upper side of the flow surface 34 so as to be open forward.

[0041] The flow surface 34 is a surface which is formed

at the intermediate portion of the guide main body 30 in the front-rear direction and which is configured to guide the oil downward from above. The flow surface 34 includes a yarn contact surface 36 and an oil discharging surface 37. The yarn contact surface 36 is a surface which is formed below the discharge port 33 and which faces substantially forward. The yarn contact surface 36 extends substantially in the up-down direction. The yarn contact surface 36 is gradually and slightly curved rearward toward, e.g., the lower side when viewed in the cross section orthogonal to the width direction (see FIG. 4). However, the disclosure is not limited to this. The yarn contact surface 36 may be provided as a substantially flat surface along, e.g., the up-down direction. The yarn contact surface 36 is configured to make contact with the yarn Y running downward from above, and formed so as to allow the oil to flow downward from above. In the yarn contact surface 36, a position (position immediately below the discharge port 33) with which the yarn Y firstly makes contact is equivalent to the upper end of the yarn contact surface 36. In the cross section cut along a direction orthogonal to the width direction (see FIG. 4), a point where the yarn Y leaves the yarn contact surface 36 is defined as a leaving point P1. The yarn Y immediately after leaving the yarn contact surface 36 runs along a tangent between the yarn contact surface 36 and the leaving point P1 (i.e., a part of a yarn path 101 through which the yarn passes (see in FIG. 4) is equivalent to the tangent).

[0042] Above the discharge port 33, a surface 39 is formed so as to face at least forward in the same manner as the yarn contact surface 36. The surface 39 extends upward and rearward with respect to the discharge port 33. The yarn Y makes contact with the lower end (end immediately above the discharge port 33) of the surface 39. The surface 39 is not included in the flow surface 34.

[0043] The oil discharging surface 37 is formed below the yarn contact surface 36, and connected to the yarn contact surface 36. The upper end of the oil discharging surface 37 is connected to the lower end of the yarn contact surface 36. The oil discharging surface 37 extends (see FIG. 4) obliquely rearward and downward. In other words, the distance between the oil discharging surface 37 and the yarn path 101 increases toward the downstream side in the oil flow direction. For example, at least an upstream part of the oil discharging surface 37 is formed as a substantially flat surface in the oil flow direction. The oil not adhering to the yarn Y flows downward along the oil discharging surface 37, and then drops on the collection passage 14 (see FIG. 2). Because of this, the oil passes through the collection passage 14, and then is collected in the collection box 15 (see FIG. 2).

[0044] The border between the yarn contact surface 36 and the oil discharging surface 37 is defined, e.g., as below. At least the upstream part, in the oil flow direction, of the oil discharging surface 37 is formed as a substantially flat surface as described above. In this regard, for example, in the cross section cut along a direction orthogonal to the width direction, a point (see a point P2 shown in FIG. 4) where a linear line extending along the outer edge of the upstream part of the oil discharging surface 37 in the oil flow direction is separated from an actual outer edge of the flow surface 34 is defined as the upstream end (i.e., upper end) of the oil discharging surface 37 in the oil flow direction. The point P2 is also equivalent to the downstream end (i.e., lower end) of the yarn contact surface 36 in the oil flow direction. In the yarn contact surface 36, for example, a range of up to 0.88 mm upward from the point P2 is defined as a downstream end portion (i.e., lower end portion) of the yarn contact surface 36 in the oil flow direction. The leaving point P1 described above is included in the downstream end portion of the yarn contact surface 36 in the oil flow direction.

[0045] The paired regulating walls 35 are formed at a front part of the guide main body 30, and extend in both the front-rear direction and up-down direction. The paired regulating walls 35 are provided on the left and right sides of the yarn contact surface 36 and the oil discharging surface 37. Paired regulating surfaces 38 (regulating surfaces 38a and 38b) are formed on inner sides, in the width direction, of the respective paired regulating walls 35. The paired regulating surfaces 38 are formed on outer sides, in the width direction, of at least the yarn contact surface 36 and the oil discharging surface 37 (i.e., both ends of the passage 31 in the width direction). The regulating surfaces 38a and 38b regulate the movement of the yarn Y in the width direction, and prevent the oil flowing through the passage 31 from spreading in the left-right direction.

[0046] Recently, the present inventors have found that oil supplied to the oil applying guide 11 tends to be disadvantageously scattered or dropped down without being collected, depending on the thickness of the yarn Y or the density of the oil. As a result of an earnest examination by the present inventors, it has been found that the scattering of the oil, etc., occurs due to causes as follows. That is, in the vicinity of the yarn Y immediately after leaving the yarn contact surface 36, the oil may be unintentionally accumulated in the space (see a space S shown in FIG. 4) surrounded by the flow surface 34 (yarn contact surface 36 and oil discharging surface 37) and the regulating surfaces 38a and 38b due to, e.g., an influence of surface tension. When the oil is unintentionally accumulated in this way, the accumulated oil is scattered from the passage 31 by being dragged by the yarn Y going out from the oil applying guide 11. Because of this, the scattering of the oil, etc., occurs.

[0047] The phenomenon described above is particularly conspicuous as the thickness of the yarn Y decreases. When the yarn Y is thin, among the oil flowing through the passage 31, the oil flowing at both end portions of the passage 31 in the width direction tends to flow toward the downstream side in the oil flow direction without making contact with the yarn Y (i.e., without adhering to the yarn Y). Because of this, the oil tends to be accumulated in the space S.

[0048] Recently, the present inventors conceived an idea of using a high density oil so as to decrease an amount of water included in the oil in order to easily evaporate the water. However, the following problem may occur when a high density oil is used. That is, a high density oil is typically high in kinematic viscosity, and does not easily adhere to the yarn Y (e.g., the oil does not easily enter the gaps between the filaments f in one yarn Y made of plural filaments f). This increases an amount of oil which flows toward the downstream side in the oil flow direction without adhering to the yarn Y. Because of this, the oil tends to be accumulated in the space S.

[0049] Therefore, in order to suppress the unintentional accumulation of the oil not adhering to the yarn Y, the oil applying guide 11 of the first embodiment is structured as follows.

(Details of Oil Applying Guide)

[0050] There is a distance between parts of the paired regulating surfaces 38 (hereinafter, it may be simply referred to as "distance"). The parts are provided on both sides, in the width direction, of the yarn contact surface 36. The distance decreases toward the lower side (the downstream side in the oil flow direction) in order to combine the filaments f. In other words, in the oil flow direction, the distance (distance G2) at the leaving point P1 (see FIG. 4) is shorter than the distance (distance G1) at the upstream end of the yarn contact surface 36, as shown in FIG. 3. The distance G2 is the shortest distance between the regulating surfaces 38a and 38b which are provided on the both sides, in the width direction, of the yarn contact surface 36. In addition to that, the distance G2 is shorter than a distance in a known product, and 0.35 mm or less (the distance in the known product is 0. 53 mm).

[0051] Because of this, the oil easily makes contact with the yarn Y (i.e., easily adheres to the yarn Y) when flowing through a narrow part of the passage 31. The present inventors considered that it was therefore possible to decrease an amount of the oil flowing toward the downstream side in the oil flow direction without adhering to the yarn Y and, as a result, to suppress the accumulation of oil in the space S.

[0052] As described above, the distance G2 is the shortest distance between the regulating surfaces 38a and 38b which are provided on the both sides, in the width direction, of the yarn contact surface 36. Because of this, the space S is small around the leaving point P1 and its surroundings so that the accumulation of the oil is suppressed in the space S. As a result, the scattering of the oil, etc., is further suppressed.

(Effect Test)

[0053] The present inventors carried out effect tests as follows, in order to test an effect of providing the distance G2 which was shorter than the distance in the known product. To begin with, as an oil applying guide, the present inventors prepared eight each of three different samples (Example 1, Example 2, and Comparative Example) described later.

[0054] The conditions of Examples and Comparative Example regarding the oil applying guide will be specified. In Example 1, the distance G1 is 1.2 mm and the distance G2 is 0.35 mm. In Example 2, the distance G1 is 0.9 mm and the distance G2 is 0.27 mm. In Comparative Example (known product), the distance G1 is 1.8 mm and the distance G2 is 0.53 mm.

[0055] As examples of a yarn Y, two different FDY yarns (48 filaments and 55 decitex, and 24 filaments and 44 decitex) which were made of polyester and which were different from one another in thickness were used. As an example of oil, oil in which the concentration in mass percentage was 90 % was used. Whether the scattering and dropping down of the oil occurred (occurrences of the scattering and dropping down of the oil) was evaluated while the oil was supplied to the oil applying guide 11 and the yarn Y was caused to run. To be more specific, whether the scattering of the oil, etc., occurred was checked as follows. Whether the scattering of the oil occurred was visually checked by putting light onto an observation target by, e.g., Clean Room Light NP-1 ("NP-1" is a model number) which was available in a clean room and which was produced by CSO CO., Ltd. A green filter which was an attachment was attached to Clean Room Light NP-1. The observed range was defined as a range which was 30 mm to 180 mm below the lower end of the oil applying guide.

[0056] To begin with, the evaluation result in which a 55 decitex yarn Y is used is shown in a table on the upper side in FIG. 5. In tables, "the occurrences of the scattering and dropping down of the oil" is evaluated with three levels (i.e., "absence", "existence of scattering", and "existence of scattering and dropping down"). "Absence" indicates a good result in which the scattering of the oil and the dropping down of the oil are not observed. "Existence of scattering" indicates that the scattering of the oil is observed while the dropping down of the oil is not observed. "Existence of scattering and dropping down" indicates that the scattering of the oil and the dropping down of the oil are observed.

[0057] In Example 1, six samples out of eight samples were evaluated as "absence", two samples out of eight samples were evaluated as "existence of scattering", and no sample out of eight samples was evaluated as "existence of scattering and dropping down". In Example 2, similarly, six samples out of eight samples were evaluated as "absence", two samples out of eight samples were evaluated as "existence of scattering", and no sample out of eight samples was evaluated as "existence of scattering and dropping down". In Comparative Example, two samples out of eight samples were evaluated as "absence", five samples out of eight samples were evaluated as "existence of scattering", and one sample out of eight samples was evaluated as "existence of scattering and

dropping down". As such, the effect to suppress the scattering of the oil, etc., was particularly conspicuous when the distance G2 was 0.35 mm or less. This is presumably because the amount of the oil flowing toward the downstream side in the oil flow direction without adhering to the yarn Y decreases as described above and, as a result, the accumulation of the oil is able to be suppressed in the space.

[0058] Subsequently, the evaluation result in which a 44 decitex yarn Y is used is shown in a table on the lower side in FIG. 5. In the evaluation result in which the 44 decitex yarn Y was used, the scattering and dropping down of the oil tended to occur more frequently than in the evaluation result in which the 55 decitex yarn Y was used. This is presumably because the oil, among the oil flowing through the passage 31, flowing at the both end portions of the passage 31 in the width direction tends to flow toward the downstream side in the oil flow direction without making contact with the yarn Y (i.e., without adhering to the yarn Y) as described above.

[0059] In Example 1, no sample was evaluated as "absence", three samples were evaluated as "existence of scattering", and five samples were evaluated as "existence of scattering and dropping down". In Example 2, no sample was evaluated as "absence", six samples were evaluated as "existence of scattering", and two samples were evaluated as "existence of scattering and dropping down". In Comparative Example, no sample was evaluated as "absence", one sample was evaluated as "existence of scattering", and seven samples were evaluated as "existence of scattering and dropping down". As such, the scattering of the oil occurred at all of the samples when the 44 decitex yarn Y was used. However, the effect to suppress the dropping down of the oil was observed when the distance G2 was 0.35 mm or less. As such, the scattering or dropping down of the oil was suppressed by providing the short distance G2, irrespective of the thickness of the yarn Y.

[0060] As described above, the distance G2 is short and 0.35 mm or less. Because of this, oil easily makes contact with a yarn Y (i.e., easily adheres to the yarn Y) when the oil flows through the part of the passage 31, which is narrow in width. It is therefore possible to decrease an amount of the oil flowing toward the downstream side in the oil flow direction without adhering to the yarn Y, and with the result that the accumulation of the oil is suppressed in the space S. Therefore, it is possible to suppress the unintentional accumulation of the oil not adhering to the yarn Y in the oil applying guide 11.

[0061] The distance G2 is the shortest distance among the distances between the regulating surfaces 38a and 38b which are provided on the both sides, in the width direction, of the yarn contact surface 36. Because of this, the space in which the oil may be accumulated is small at the leaving point P1 and its surroundings. As a result, the scattering of the oil, etc., is further suppressed.

[0062] Because the yarn Y is typically spun out at high speed from the spinning apparatus 2, the oil which is unintentionally accumulated is highly likely to be, e.g., scattered by being dragged by the yarn Y running at high speed. It is especially effective to apply the oil applying guide 11 to the spun yarn take-up machine 1 structured in this way so as to suppress the unintentional accumulation of the oil not adhering to the yarn Y.

[0063] When the oil is applied to the thin yarn Y which is 55 decitex or less, among the oil flowing through the passage 31, the oil flowing at the both end portions of the passage 31 in the width direction tends to flow toward the downstream side in the oil flow direction without making contact with the yarn Y (i.e., without adhering to the yarn Y). Because of this, an amount of the oil unintentionally accumulated may be increased in the oil applying guide 11. It is especially effective to apply the oil applying guide 11 to the spun yarn take-up machine 1 structured in this way, so as to suppress the unintentional accumulation of the oil not adhering to the yarn Y.

[0064] The high density oil the concentration of which is 85 % or more in mass percentage is unlikely to adhere to the yarn Y due to the high kinematic viscosity. Because of this, an amount of the oil flowing toward the downstream side in the oil flow direction without adhering to the yarn Y is increased. It is especially effective to apply the oil applying guide 11 to the spun yarn take-up machine 1 structured in this way, so as to suppress the unintentional accumulation of the oil not adhering to the yarn Y.

<Second Embodiment>

[0065] The following will describe a second embodiment of the present invention with reference to FIG. 6 and FIGs. 7(a) and 7(b). Components which are equivalent to or the same as those in the first embodiment are given the same reference numerals, and the descriptions thereof are not repeated, if appropriate. FIG. 6 is a front view of an oil applying guide 40 related to the second embodiment. FIG. 7(a) is a cross section taken along a line VII-VII in FIG. 6. FIG. 7(b) is an enlarged view of a region R1 indicated in FIG. 7(a)

[0066] Being similar to the oil applying guide 11 of the first embodiment, the oil applying guide 40 (see FIG. 6 and FIGs. 7(a) and 7(b)) of the second embodiment is a guide provided in the oil applicator 3 (see FIG. 1) of the spun yarn take-up machine 1 (see FIG. 1).

(Oil Applying Guide)

[0067] The structure of the oil applying guide 40 will be described. The oil applying guide 40 includes a guide main body 50 (corresponding to the guide main body 30 of the oil applying guide 11) in which a passage 51 (corresponding to the passage 31 of the oil applying guide 11) is formed. The passage 51 includes a supply hole 52, a discharge port 53, a flow surface 54 (yarn contact surface 56 and oil discharging surface 57), and paired regulation walls 55 (regulating walls 55a and 55b).

[0068] The supply hole 52 corresponds to the supply hole 32 of the oil applying guide 11. The discharge port 53 corresponds to the discharge port 33 of the oil applying guide 11. The flow surface 54 corresponds to the flow surface 34 of the oil applying guide 11. The yarn contact surface 56 corresponds to the yarn contact surface 36 of the oil applying guide 11. The oil discharging surface 57 corresponds to the oil discharging surface 37 of the oil applying guide 11. The paired regulating walls 55 correspond to the paired regulating walls 35 of the oil applying guide 11. Regulating surfaces 58 (regulating surfaces 58a and 58b) corresponding to the regulating surfaces 38 of the oil applying guide 11 are formed on the paired regulating walls 55. Above the discharge port 53, a surface 59 corresponding to the surface 39 of the oil applying guide 11 is formed. The following will describe similarities and differences between the oil applying guide 40 and the oil applying guide 11.

[0069] The lower end portion of the yarn contact surface 56 is defined in the same manner as in the oil applying guide 11. In the cross section cut along a direction orthogonal to the width direction (see FIG. 7(a)), a point where the yarn Y leaves the yarn contact surface 56 is defined as a leaving point P3. The yarn Y immediately after leaving the yarn contact surface 56 runs to draw a tangent of the yarn contact surface 56, a contact point of which is the leaving point P3 (i.e., a part of a yarn path 102 is equivalent to the tangent; the yarn Y passes through the yarn path 102).

[0070] The upper end of the oil discharging surface 57 is connected to the lower end of the yarn contact surface 56. The distance between the oil discharging surface 57 and the yarn path 102 increases rearward and toward the downstream side in the oil flow direction (see FIG. 7(a)). The entire oil discharging surface 57 is provided as a substantially flat surface in the, e.g., oil flow direction (i.e., substantially linear in the cross section cut along a direction orthogonal to the width direction).

[0071] The border between the yarn contact surface 56 and the oil discharging surface 57 is defined, e.g., as below in the same manner as in the oil applying guide 11. In other words, in the cross section cut along a direction orthogonal to the width direction, a point (see a point P4 shown in FIG. 7(a)) where a linear line extending along the outer edge of the upstream part of the oil discharging surface 57 in the oil flow direction is separated from an actual outer edge of the flow surface 54 is defined as the upstream end (i.e., upper end) of the oil discharging surface 57 in the oil flow direction. The point P4 is also equivalent to the downstream end (i.e., lower end) of the yarn contact surface 56 in the oil flow direction. In the yarn contact surface 56, for example, an area which is within 0.61 mm or less above the point P4 is defined as a downstream end portion (i.e., lower end portion) of the yarn contact surface 56 in the oil flow direction. The leaving point P3 is included in the downstream end portion of the yarn contact surface 56 in the oil flow direction. In the oil discharging surface 57, for example, an area which is within 3 mm or less behind the point P4 is defined as an upstream end portion of the yarn contact surface 57 in the oil flow direction.

[0072] In the oil applying guide 40, the paired regulating surfaces 58 are formed on both sides, in the width direction, of the yarn contact surface 56. However, the paired regulating surfaces 58 are not formed on both sides, in the width direction, of the oil discharging surface 57. In other words, on the downstream side of the leaving point P3 in the oil flow direction, there is the part in which the regulating surfaces 58a and 58b are not formed in the passage 51. Because of this, on the downstream side of the leaving point P3 in the oil flow direction, the space (i.e., the space in which the oil may be accumulated) surrounded by the flow surface 54 and the regulating surfaces 58a and 58b is small. In this regard, the paired regulating surfaces 58 are not formed on the both sides, in the width direction, of the entire oil discharging surface 57 in FIG. 7(a).

[0073] The distance (hereinafter, it is simply referred to as "distance") between the regulating surfaces 58a and 58b in the width direction decreases toward the lower side (the downstream side in the oil flow direction), in the same manner as in the oil applying guide 11. In other words, as shown in FIG. 5, the distance (distance G2) provided at the leaving point P3 in the oil flow direction is shorter than the distance (distance G1) provided at the upstream end of the yarn contact surface 56 in the oil flow direction. The distance G2 is the shortest distance among the distances between the regulating surfaces 58a and 58b.

[0074] As shown in FIG. 7(a), in the cross section cut along a direction orthogonal to the width direction, an angle formed between the tangent (see the yarn path 102) of the yarn contact surface 56 the contact point of which is the leaving point P3 and the upstream end portion of the oil discharging surface 57 in the oil flow direction is defined as an angle θa. In this regard, the angle θa is preferably, e.g., 50 degrees or more. This is because, when the angle θa is small, the oil may tend to be accumulated due to increase of the influence of surface tension in the space formed between the yarn Y immediately after leaving the yarn contact surface 56 and the oil discharging surface 57. By increasing the angle θa to 50 degrees or more, the influence of surface tension is decreased so as to suppress the accumulation of the oil in the space formed between the yarn Y and the oil discharging surface 57. This structure may be applied to the oil applying guide 11 of the first embodiment.

[0075] As described in the second embodiment, when the guide main body 50 is provided so that the yarn Y running downward from above makes contact with the yarn contact surface 56, an angle formed between the oil discharging surface 57 and the vertical line is defined as an angle θb in the cross section cut along a direction orthogonal to the width direction. To be more specific, the angle θb is an angle formed between the vertical line and the surface of the upstream end portion (defined as

above) of the oil discharging surface 57 in the oil flow direction. It is preferable that the angle θb is within, e.g., a range of 60 to 72 degrees. By increasing the angle θb to 60 degrees or more, the influence of surface tension is decreased so as to suppress the accumulation of the oil in the space formed between the yarn Y and the oil discharging surface 57. In addition to that, because the angle θb is decreased to 72 degrees or less, the direction of the oil discharging surface 57 is arranged to be close to the vertical direction, so that the component of gravity in the direction along the oil discharging surface 57 is increased. Therefore, by the gravity, the oil is smoothly discharged along the oil discharging surface 57. This structure may be applied to the oil applying guide 11 of the first embodiment.

[0076] As shown in FIG. 7(b), when a distance in the front-rear direction between the leaving point P3 and the front ends of the regulating walls 55 is defined as a distance L, the space (space in which the oil may be accumulated) surrounded by the flow surface 54 and the regulating surfaces 58a and 58b can be decreased in size by decreasing the distance L. In this regard, when the distance L is excessively short, the oil may be scattered to the front. It is therefore preferable that the distance L is, e.g., 0.75 mm or more. This structure may be applied to the oil applying guide 11 of the first embodiment.

(Effect Test)

[0077] The present inventors carried out effect tests as follows in the same manner as in the first embodiment, in order to test an effect of not providing the regulating surfaces 58a and 58b on the both sides, in the width direction, of the oil discharging surface 57. The present inventors prepared eight each of two different samples (Example 2 described above and Example 3 described later) as an oil applying guide. Each sample used in Example 3 is the oil applying guide 40 related to the second embodiment. The sample used in Example 3 is substantially the same as each sample (the oil applying guide 11) used in Example 2 described above, except that the regulating surfaces 58a and 58b are not formed on the both sides, in the width direction, of the oil discharging surface 57 in the sample used in Example 3. That is, in the sample used in Example 3, the distance G1 is 0.9 mm and the distance G2 is 0.27 mm. Conditions of the effect tests such as the type of the yarn Y caused to run and the density of the oil are the same as the conditions of the effect tests described in the first embodiment.

[0078] To begin with, the evaluation result in which a 55 decitex yarn Y is used is shown in a table on the upper side in FIG. 8. In Example 3, eight samples out of eight samples were evaluated as "absence", no sample out of eight samples was evaluated as "existence of scattering", and no sample out of eight samples was evaluated as "existence of scattering and dropping down". The evaluation result in which a 44 decitex yarn Y is used is shown in a table on the lower side in FIG. 8. In Example 3, eight samples out of eight samples were evaluated as "absence", no sample out of eight samples was evaluated as "existence of scattering", and no sample out of eight samples was evaluated as "existence of scattering and dropping down". In both cases where the yarns Y which were different for one another in thickness were caused to run, the scattering and dropping down of the oil were observed. This is presumably because, as described above, the unintentional accumulation of the oil is suppressed by the small space in which the oil may be accumulated.

[0079] As described above, on the downstream side of the leaving point P3 in the oil flow direction, there is the part in which the regulating surfaces 58a and 58b are not formed. Because of this, on the downstream side of the leaving point P3 in the oil flow direction, the space (i.e., the space in which the oil may be accumulated) surrounded by the flow surface 54 and the regulating surfaces 58a and 58b is small. Therefore, in the oil applying guide 40, it is possible to suppress the unintentional accumulation of the oil not adhering to the yarn Y.

[0080] Because the angle θa described above is large, i.e., 50 degrees or more so that the influence of surface tension is decreased, the accumulation of the oil is suppressed in the space formed between the yarn Y and the oil discharging surface 57.

[0081] Because the angle θb described above is within the range of 60 to 72 degrees so that the influence of surface tension is decreased, the accumulation of the oil is suppressed in the space formed between the yarn Y and the oil discharging surface 57. In addition to that, the component of gravity in the direction along the oil discharging surface 57 is increased. Therefore, by the gravity, the oil is smoothly discharged along the oil discharging surface 57.

[0082] The following will describe modifications of the second embodiment. Components which are equivalent to or the same as those in the second embodiment are given the same reference numerals, and the descriptions thereof are not repeated, if appropriate.

(1) While the paired regulating surfaces 58 are not formed on the both sides, in the width direction, of the oil discharging surface 57 at all, the disclosure is not limited to this. For example, the paired regulating surfaces 58 may not be formed on both sides, in the width direction, of the upstream end portion (defined as above) of the oil discharging surface 57 in the oil flow direction and may be formed on the both sides of the oil discharging surface 57 except the upstream end portion. In other words, the paired regulating surfaces 58 may be arranged as long as the paired regulating surfaces 58 are not formed on both sides, in the width direction, of at least the upstream end portion of the oil discharging surface 57 in the oil flow direction.

(2) While the above described distance G2 in Example 3 is 0.27 mm (i.e., the distance G2 in Example 3

is the same as that in Example 2), the value of the distance G2 is not limited to this. That is, the space in which the oil may be accumulated is small in the vicinity of the yarn Y immediately after leaving the yarn contact surface 56 because the regulating surfaces 58a and 58b are not formed on the both sides, in the width direction, of the upstream end portion of the oil discharging surface 57 in the oil flow direction. With this arrangement, the unintentional accumulation of the oil not adhering to the yarn Y is suppressed.

(3) While the angle θa described above is preferably 50 degrees or more, the disclosure is not limited to this. The angle θa may be smaller than 50 degrees.

(4) While the angle θb described above is preferably within the range of 60 to 72 degrees, the disclosure is not limited to this. The angle θb may be smaller than 60 degrees, or may be larger than 72 degrees.

(5) As described above, by increasing the angle θa, the accumulation of the oil is suppressed in the space formed between the yarn Y and the oil discharging surface 57. Meanwhile, when the angle θb is increased by increasing the angle θa, the direction of the oil discharging surface 57 is arranged to be close to the horizontal direction. Therefore, the discharging efficiency of the oil by means of the gravity may be decreased (especially, when the flowing of the oil starts before the yarn Y runs, the discharging efficiency of the oil is further decreased). To be more specific, when it becomes difficult to discharge the oil from the downstream part of the oil discharging surface 57 in the oil flow direction, the oil may tend to be accumulated also at the upstream part of the oil discharging surface 57. As shown in FIG. 9, for example, being different from the oil discharging surface 57 described above, an entire oil discharging surface 61 of the oil applying guide 60 may not be formed as a substantially flat surface. The oil discharging surface 61 includes, e.g., a first discharging surface 62 and a second discharging surface 63. The first discharging surface 62 is a surface formed immediately below the yarn contact surface 56 in an oil discharging direction. In the cross section cut along a direction orthogonal to the width direction, an angle (first angle) formed between the first discharging surface 62 and the vertical line is the angle θb described above. The second discharging surface 63 is a surface formed downstream of the first discharging surface 62 in the oil discharging direction. The second discharging surface 63 is bent with respect to the first discharging surface 62. In the cross section cut along a direction orthogonal to the width direction, when an angle (second angle) formed between the second discharging surface 63 and the vertical line is defined as an angle θc, the angle θc is smaller than the angle θb. Because of this, the angle θc can be decreased even when the angle θb is increased. It is therefore possible to suppress decrease of the discharging efficiency of the oil by means of the gravity. To be more specific, it is preferable that the angle θc is 50 degrees or less. The present inventors found that the decrease of the discharging efficiency of the oil was further reliably suppressed by decreasing the angle θc to 50 degrees or less. This modification may be applied to the oil applying guide 11 of the first embodiment. In this regard, the angles θa and θb may be within, e.g., the range shown in the second embodiment. However, the disclosure is not limited to this.

[0083] The following will describe modifications related to both the first embodiment and the second embodiment.

(1) The part of the yarn path 101 (yarn path 102), which is provided downstream of the leaving point P1 (leaving point P3) in the yarn running direction, is the same as the tangent the contact point of which is the leaving point P1 (leaving point P3). However, the disclosure is not limited to this. For example, the yarn Y may be bent rearward at the point where the yarn Y leaves the yarn contact surface 36 (yarn contact surface 56) formed as a substantially flat surface.

(2) While the distance G2 described above is the shortest distance among the distances in the width direction between the paired regulating surfaces 38 (paired regulating surfaces 58), the disclosure is not limited to this. The distance may be the shortest distance provided upstream or downstream of the position where, e.g., the leaving point P1 (leaving point P3) is provided in the oil flow direction.

(3) While each of the oil applying guides 11 and 40 is provided in the spun yarn take-up machine 1, the disclosure is not limited to this. Each of the oil applying guide 11 and 40 may be provided in a textile machine which is different from the spun yarn take-up machine 1 and which is configured to cause yarns to run downward from above.

Claims

1. An oil applying guide (11) which applies oil to a yarn (Y) running downward from above, the oil applying guide (11) comprising
a guide main body (30) in which a passage (31) allowing the oil to flow downward from above is formed, and
the passage (31) including:

a yarn contact surface (36) with which the yarn (Y) makes contact, the yarn (Y) leaving the yarn contact surface (36) at a downstream end portion of the yarn contact surface (36) in an oil flow direction in which the oil flows;

an oil discharging surface (37) which allows the oil to be discharged, which is provided downstream of the yarn contact surface (36) in the oil flow direction, and which is formed so that a distance between the oil discharging surface (37) and a yarn path (101) increases toward a downstream side in the oil flow direction; and
paired regulating surfaces (38) formed at both ends, in a width direction of the passage (31), of the passage (31), and
on the yarn contact surface (36), the minimum distance in the width direction between the paired regulating surfaces (38) being 0.35 mm or less.

2. An oil applying guide (40, 60) which applies oil to a yarn (Y) running downward from above, the oil applying guide (40, 60) comprising
a guide main body (50) in which a passage (51) allowing the oil to flow downward from above is formed, and
the passage (51) including:

a yarn contact surface (56) with which the yarn (Y) makes contact, the yarn (Y) leaving the yarn contact surface (56) at a downstream end portion of the yarn contact surface (56) in an oil flow direction in which the oil flows;
an oil discharging surface (57, 61) which allows the oil to be discharged, which is provided downstream of the yarn contact surface (56) in the oil flow direction, and which is formed so that a distance between the oil discharging surface (57, 61) and a yarn path (102) increases toward a downstream side in the oil flow direction; and
paired regulating surfaces (58) formed at both ends, in a width direction of the passage (51), of the passage (51) ,
the paired regulating surfaces (58) being formed on both sides, in the width direction, of the yarn contact surface (56), and not being formed on both sides, in the width direction, of at least an upstream end portion of the oil discharging surface (57, 61) in the oil flow direction.

3. The oil applying guide (11, 40, 60) according to claim 1 or 2, wherein, the minimum distance in the width direction between the regulating surfaces (38, 58) formed on the both sides of the yarn contact surface (36, 56) is the shortest at a position where the yarn (Y) leaves the yarn contact surface (36, 56).

4. The oil applying guide (40, 60) according to any one of claims 1 to 3, wherein, in a cross section cut along a direction orthogonal to the width direction, an angle (θa) formed between a yarn path (102) extending from a point (P3) where the yarn (Y) leaves the yarn contact surface (56) toward a downstream side in a yarn running direction and an upstream end portion, in the oil flow direction, of the oil discharging surface (57, 61) is 50 degrees or more.

5. The oil applying guide (40, 60) according to any one of claims 1 to 4, wherein, when the guide main body (50) is provided so that the yarn (Y) running downward from above makes contact with the yarn contact surface (56), an angle (θb) formed between the oil discharging surface (57, 61) and the vertical line is within a range of 60 to 72 degrees in the cross section cut along a direction orthogonal to the width direction.

6. The oil applying guide (60) according to claim 1 or 2, wherein, the oil discharging surface (61) includes:

a first discharging surface (62) provided downstream of the yarn contact surface (56) in the oil flow direction; and
a second discharging surface (63) which is provided downstream of the first discharging surface (62) in the oil flow direction and which is bent with respect to the first discharging surface (62), and
when the guide main body (50) is provided so that the yarn (Y) running downward from above makes contact with the yarn contact surface (56), as compared to a first angle (θb) formed between the first discharging surface (62) and the vertical line, a second angle (θc) formed between the second discharging surface (63) and the vertical line being small in the cross section cut along a direction orthogonal to the width direction.

7. The oil applying guide (60) according to claim 6, wherein, the second angle (θc) is 50 degrees or less.

8. A spun yarn take-up machine (1) comprising: a spinning apparatus (2) configured to spin out a yarn (Y); a take-up apparatus (5) configured to take up the yarn (Y) spun out from the spinning apparatus (2) and to wind the yarn (Y) onto a bobbin (B); and the oil applying guide (11, 40, 60) according to any one of claims 1 to 7, which is provided between the spinning apparatus (2) and the take-up apparatus (5) in the yarn running direction.

9. The spun yarn take-up machine (1) according to claim 8, wherein, the spinning apparatus (2) is configured to be able to spin out yarns (Y) each of which is 55 decitex or less in thickness.

10. The spun yarn take-up machine (1) according to claim 8 or 9, further comprising an oiling device (12) configured to be able to supply oil in which the concentration in mass percentage is 85 & or more to the

oil applying guide (11, 40, 60).

FIG.1

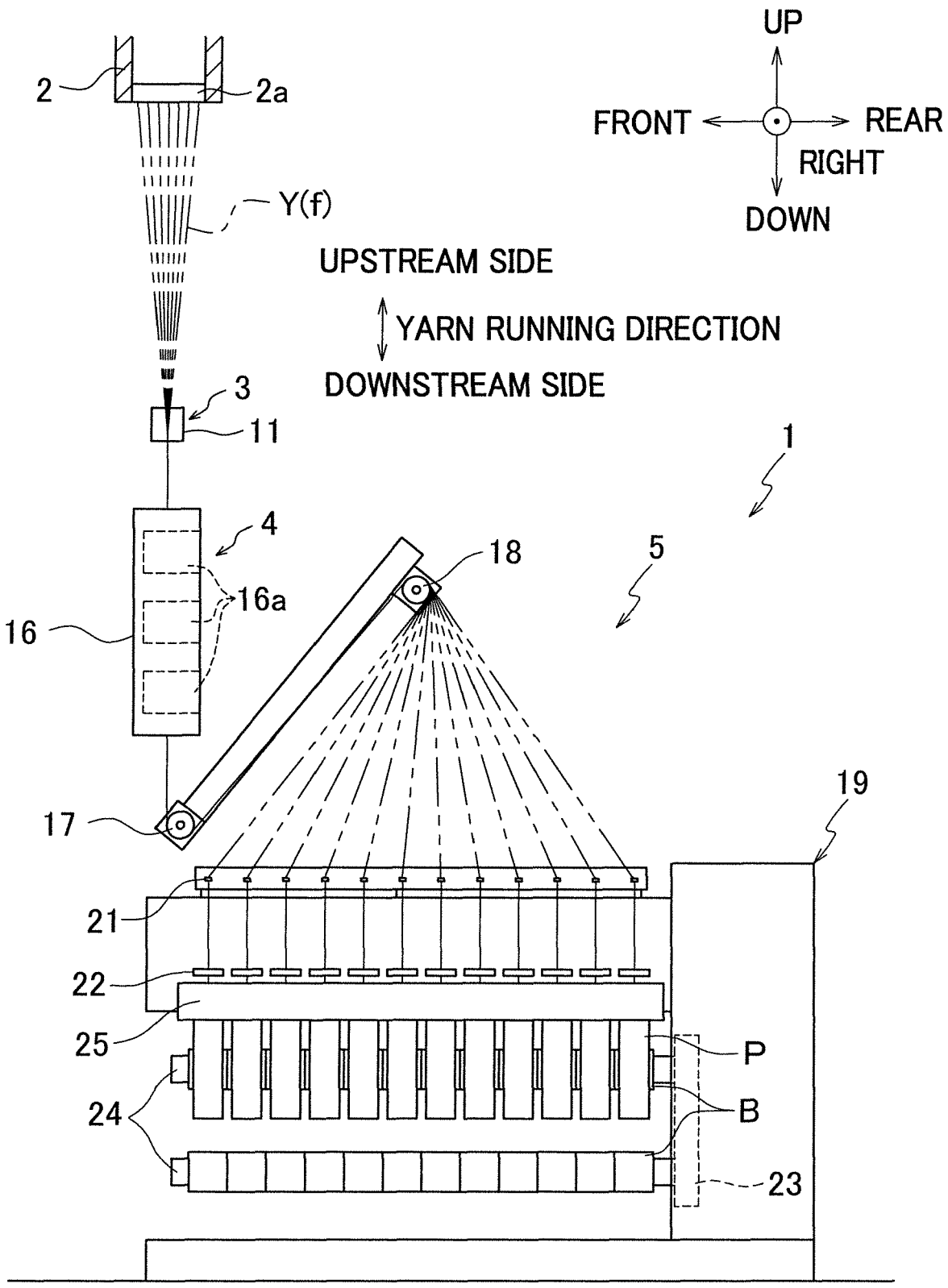

UP
FRONT
REAR
RIGHT
DOWN
2
2a
Y(f)
UPSTREAM SIDE
YARN RUNNING DIRECTION
DOWNSTREAM SIDE
3
11
1
4
18
5
16a
16
17
19
21
22
25
P
24
B
23

FIG.2

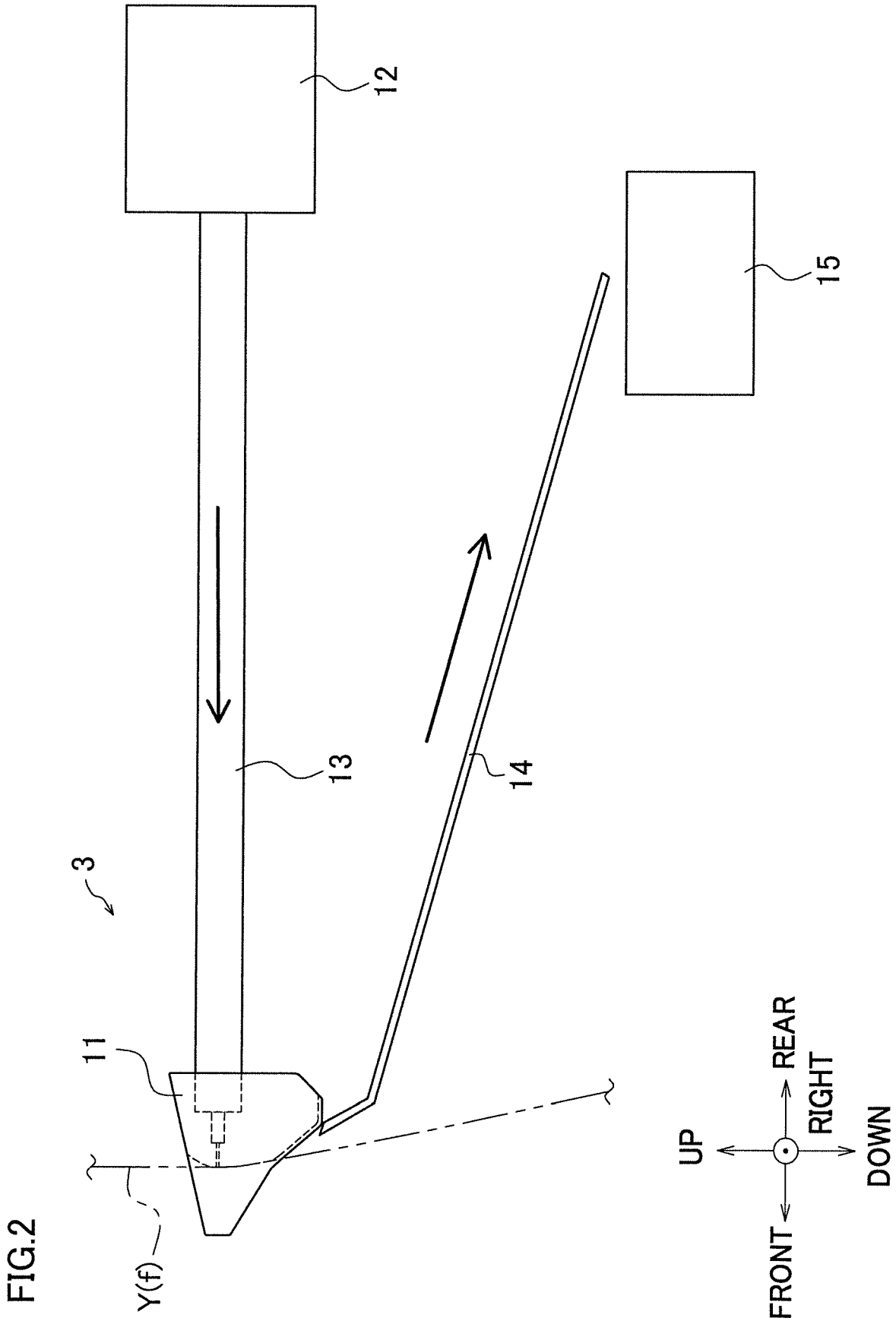


FIG.3

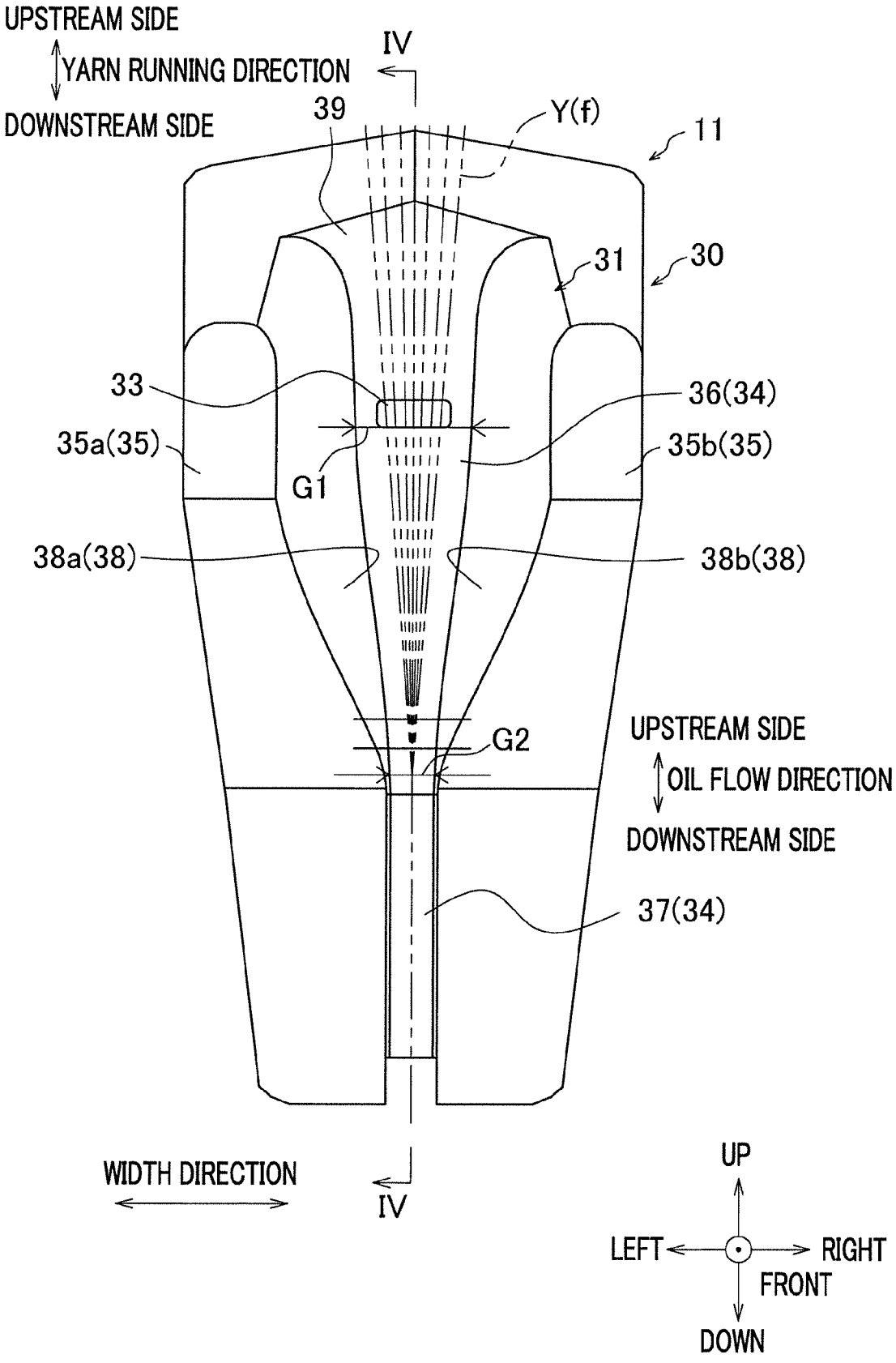

UPSTREAM SIDE
YARN RUNNING DIRECTION
DOWNSTREAM SIDE
IV
39
Y(f)
11
31
30
33
36(34)
35a(35)
35b(35)
G1
38a(38)
38b(38)
G2
UPSTREAM SIDE
OIL FLOW DIRECTION
DOWNSTREAM SIDE
37(34)
WIDTH DIRECTION
IV
UP
LEFT
RIGHT
FRONT
DOWN

FIG.4

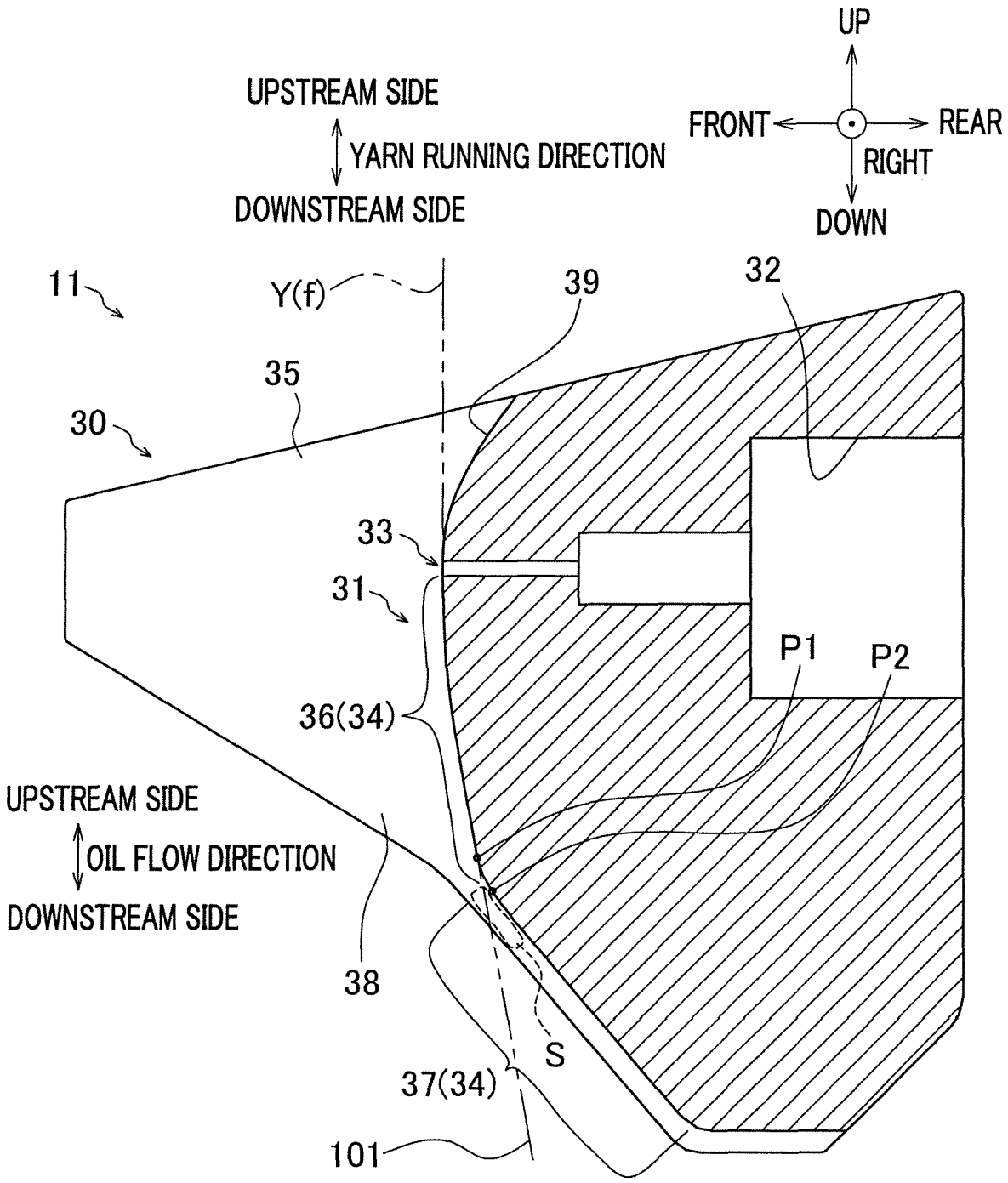

UP
FRONT
REAR
RIGHT
DOWN
UPSTREAM SIDE
YARN RUNNING DIRECTION
DOWNSTREAM SIDE
11
Y(f)
39
32
35
30
33
31
P1
P2
36(34)
UPSTREAM SIDE
OIL FLOW DIRECTION
DOWNSTREAM SIDE
38
S
37(34)
101

FIG.5

THICKNESS OF YARN:55dtex

	DISTANCE		OCCURRENCES OF SCATTERING AND DROPPING DOWN OF OIL		
	G1[mm]	G2[mm]	ABSENCE	EXISTENCE OF SCATTERING	EXISTENCE OF SCATTERING AND DROPPING DOWN
EXAMPLE 1	1.2	0.35	6	2	
EXAMPLE 2	0.9	0.27	6	2	
COMPARATIVE EXAMPLE	1.8	0.53	2	5	1

THICKNESS OF YARN:44dtex

	DISTANCE		OCCURRENCES OF SCATTERING AND DROPPING DOWN OF OIL		
	G1[mm]	G2[mm]	ABSENCE	EXISTENCE OF SCATTERING	EXISTENCE OF SCATTERING AND DROPPING DOWN
EXAMPLE 1	1.2	0.35		3	5
EXAMPLE 2	0.9	0.27		6	2
COMPARATIVE EXAMPLE	1.8	0.53		1	7

FIG.6

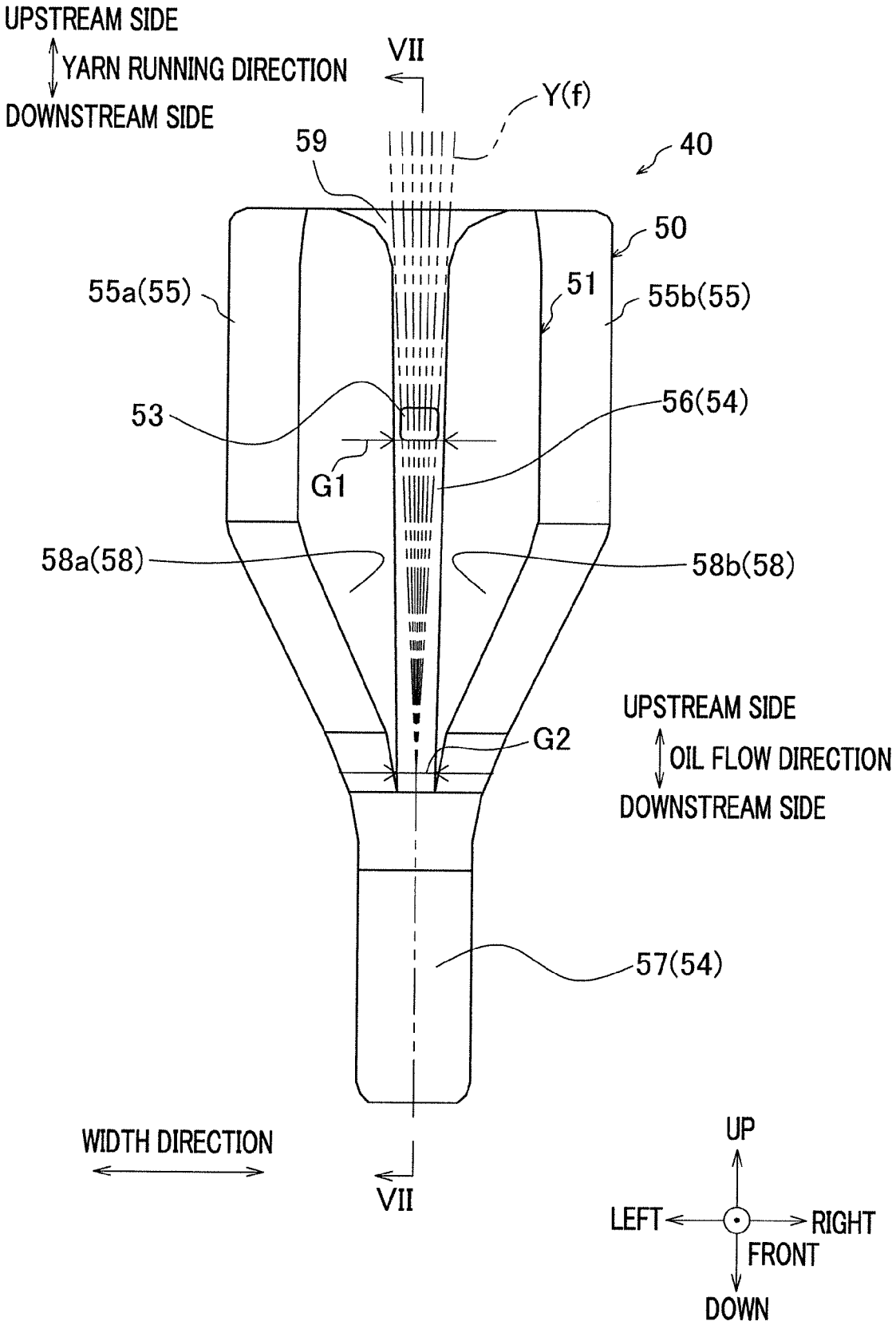

UPSTREAM SIDE
YARN RUNNING DIRECTION
DOWNSTREAM SIDE
VII
Y(f)
59
40
50
55a(55)
51
55b(55)
53
56(54)
G1
58a(58)
58b(58)
UPSTREAM SIDE
OIL FLOW DIRECTION
DOWNSTREAM SIDE
G2
57(54)
WIDTH DIRECTION
VII
UP
LEFT
RIGHT
FRONT
DOWN

FIG.7

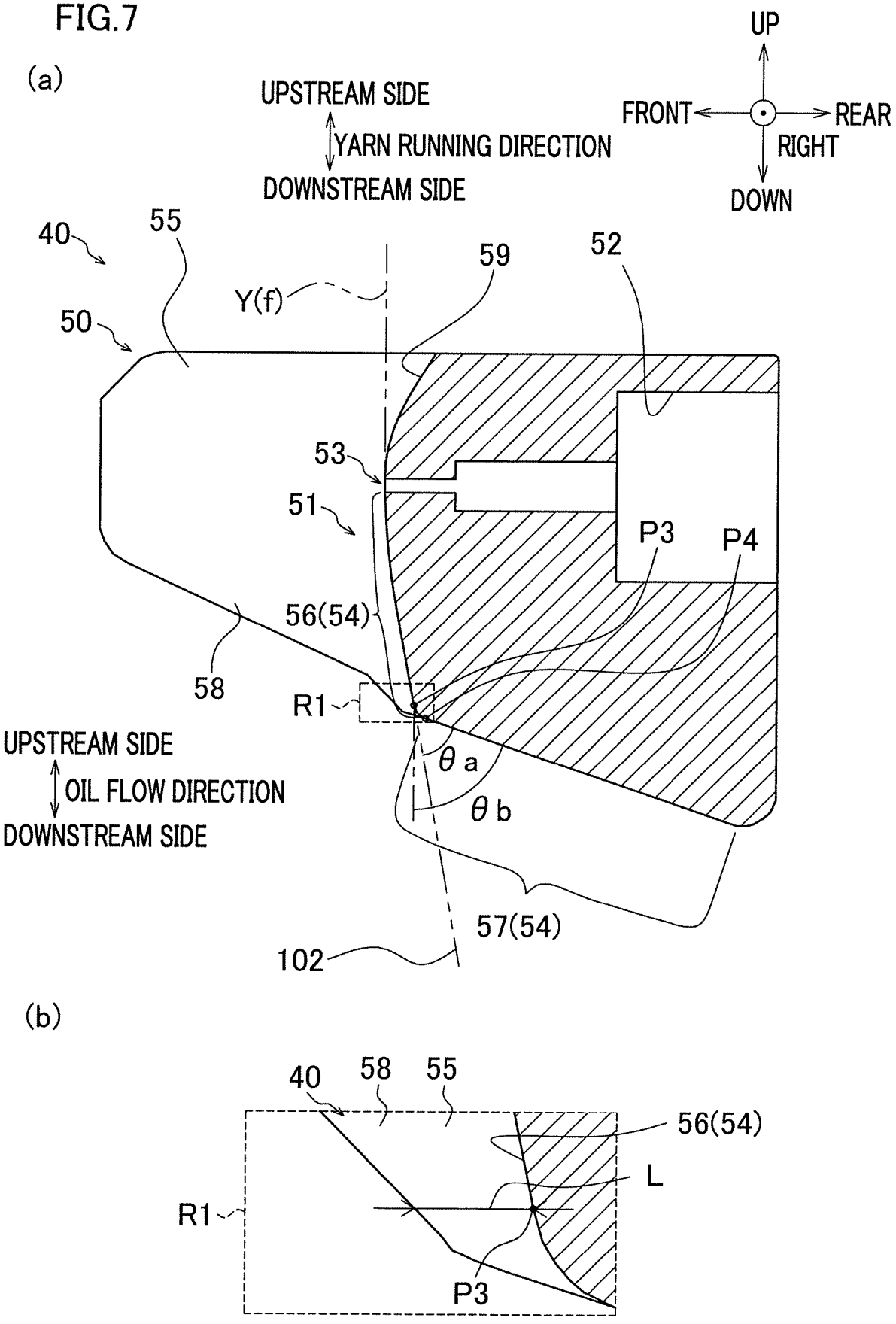

(a)
UP
FRONT
REAR
RIGHT
DOWN
UPSTREAM SIDE
YARN RUNNING DIRECTION
DOWNSTREAM SIDE
40
55
59
52
Y(f)
50
53
51
P3
P4
56(54)
58
R1
θ a
θ b
UPSTREAM SIDE
OIL FLOW DIRECTION
DOWNSTREAM SIDE
57(54)
102
(b)
40
58
55
56(54)
L
R1
P3

FIG.8

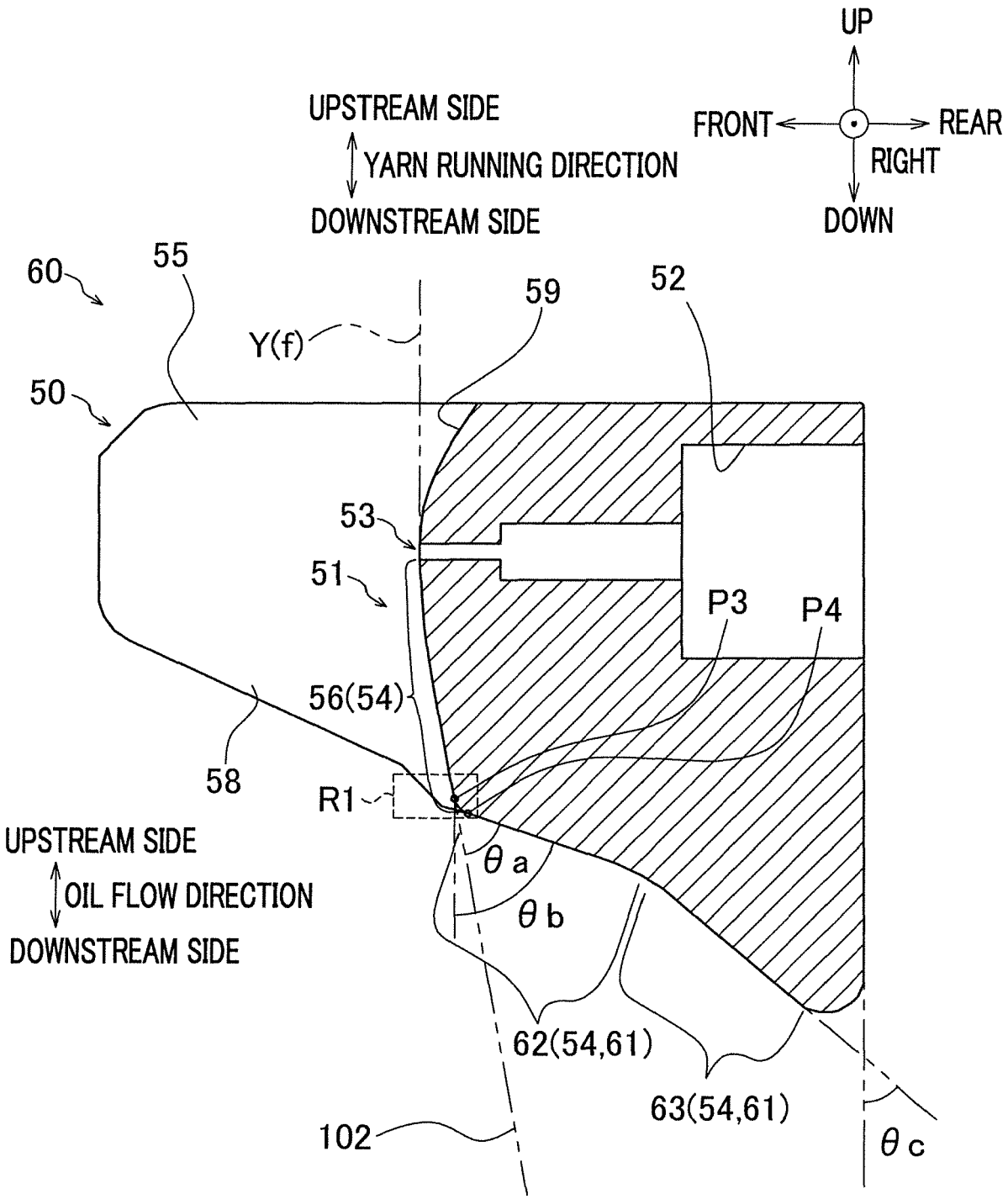
THICKNESS OF YARN:55dtex

	DISTANCE		OCCURRENCES OF SCATTERING AND DROPPING DOWN OF OIL		
	G1[mm]	G2[mm]	ABSENCE	EXISTENCE OF SCATTERING	EXISTENCE OF SCATTERING AND DROPPING DOWN
EXAMPLE 2	0.9	0.27	6	2	
EXAMPLE 3	0.9	0.27	8		

THICKNESS OF YARN:44dtex

	DISTANCE		OCCURRENCES OF SCATTERING AND DROPPING DOWN OF OIL		
	G1[mm]	G2[mm]	ABSENCE	EXISTENCE OF SCATTERING	EXISTENCE OF SCATTERING AND DROPPING DOWN
EXAMPLE 2	0.9	0.27		6	2
EXAMPLE 3	0.9	0.27	8		

FIG.9


UP
FRONT
REAR
RIGHT
DOWN
UPSTREAM SIDE
YARN RUNNING DIRECTION
DOWNSTREAM SIDE
60
55
59
52
Y(f)
50
53
51
P3
P4
56(54)
58
R1
θ a
θ b
UPSTREAM SIDE
OIL FLOW DIRECTION
DOWNSTREAM SIDE
62(54,61)
63(54,61)
102
θ c

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 21 15 5182

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	WO 03/060204 A1 (TOYO BOSEKI [JP]; OHIE YOSHINOBU [JP] ET AL.) 24 July 2003 (2003-07-24) * paragraphs [0099], [0143], [0146]; figures * -----	1,3-5,8, 9 6,7,10	INV. B65H71/00 D01D5/096 D06B1/08 D06B3/04
X	JP 2004 076236 A (NIPPON ESTER CO LTD) 11 March 2004 (2004-03-11) * figures * -----	2,8-10	
X Y	JP H11 61551 A (TEIJIN LTD) 5 March 1999 (1999-03-05) * figures * -----	2-5,8-10 6,7	
Y	DE 10 2016 005925 A1 (OERLIKON TEXTILE GMBH & CO KG [DE]) 26 January 2017 (2017-01-26) * paragraph [0035]; figure 1 * -----	6,7	
Y	EP 3 521 486 A1 (TMT MACHINERY INC [JP]) 7 August 2019 (2019-08-07) * paragraph [0048]; figures * -----	10	

TECHNICAL FIELDS SEARCHED (IPC)

B65H
D01F
D01D
D06B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	15 June 2021	Lemmen, René

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 21 15 5182

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

15-06-2021

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 03060204 A1	24-07-2003	AU 2002349612 A1	30-07-2003
		CN 1608149 A	20-04-2005
		ES 2267369 A1	01-03-2007
		TW 200301324 A	01-07-2003
		WO 03060204 A1	24-07-2003
JP 2004076236 A	11-03-2004	JP 4033738 B2	16-01-2008
		JP 2004076236 A	11-03-2004
JP H1161551 A	05-03-1999	NONE	
DE 102016005925 A1	26-01-2017	NONE	
EP 3521486 A1	07-08-2019	CN 110117827 A	13-08-2019
		EP 3521486 A1	07-08-2019
		JP 2019135335 A	15-08-2019
		KR 20190095116 A	14-08-2019
		TW 201934822 A	01-09-2019

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2002309432 A **[0002]**