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(54) **LINEAR GRINDING MATERIAL, BRUSH-SHAPED GRINDSTONE AND METHOD FOR MANUFACTURING LINEAR GRINDING MATERIAL**

LINEARES SCHLEIFMATERIAL, BÜRSTENFÖRMIGER SCHLEIFSTEIN UND VERFAHREN ZUR HERSTELLUNG EINES LINEAREN SCHLEIFMATERIALS

MATIÈRE ABRASIVE LINÉAIRE, MEULE EN FORME DE BROSSE ET PROCÉDÉ DE FABRICATION DE MATIÈRE ABRASIVE LINÉAIRE

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Description

Field

[0001] The present invention relates to: a linear grinding member including inorganic filaments stiffened with a resin binder, a brush-like grinding stone having linear grinding members held by a holder, and a method for manufacturing a linear grinding member.

Background

[0002] Patent Literatures 1 and 2 disclose brush-like grinding stones each including a plurality of linear grinding members, and a holder that holds these linear grinding members in a bundle. When each of these brush-like grinding stones is used, for example, for deburring or polishing a surface of a metal workpiece, the tips of the linear grinding members grind or polish the surface while the brush-like grinding stone is rotated about the axis thereof, Patent Literature 1 discloses, as a method for manufacturing a linear grinding member, a method including: impregnating a composite yarn including inorganic filaments and a resin binder; then winding it up while removing excess resin with a squeezing roller; and then thermally curing the resin binder.

[0003] Patent Literature 3 discloses the preamble of claim 1.

[0004] Patent Literature 3 further discloses a method for manufacturing a linear grinding member obtained by stiffening, with a resin binder a composite yarn including inorganic filaments, the method comprising a twisting step of twisting the composite yarn, subsequently an impregnation step of impregnating the composite yarn with an uncured resin binder, a shaping step to shape a cross-sectional shape of the composite yarn into a ellipse with an aspect ratio which is in a range of 1.1 to 5.0 and a resin-curing step of curing the resin binder after the shaping step or in parallel with the shaping step.

Citation List

Patent Literatures

[0005]

Patent Literature 1: Japanese Patent Laid-open Publication No. 2002-210662
Patent Literature 2: WO2004/009293
Patent Literature 3: EP 1 543 924

Summary

Technical Problem

[0006] In the manufacturing method disclosed in Patent Literature 1, when a composite yarn including inorganic filaments is driven while being placed on a roller or the like, the composite yarn is moderately pressed against the roller. As a result, the cross section of the composite yarn is formed into a circular shape. Thus, a linear grinding member having a circular cross section is manufactured.

[0007] In this respect, bending of a linear grinding member having a circular cross section is uniformly likely in all directions. The linear grinding member makes regular motions, therefore providing no edge effect, during processing. As a result, the linear grinding member cannot fully exert its grinding performance in some cases.

[0008] In consideration of the above problem, the present invention aims at providing a linear grinding member and a brush-like grinding stone that have edge effects and provides high grinding performance. The present invention also aims at providing a method for manufacturing such a linear grinding member.

Solution to Problem

[0009] The present invention has been made based on new knowledge found by the inventors that, when a linear grinding member is used in a brush-like grinding stone, the cross-sectional shape of the linear grinding member affects the polishing performance and the grinding performance thereof.

[0010] In order to solve the above problem, the present invention provides a linear grinding member according to claim 1. In the present invention, a linear grinding member having a rectangular cross-sectional shape has a cross section thinner in the thickness direction than in the width direction (a direction along the long sides). Therefore, the tip thereof easily breaks, and the self-sharpening action for generating a new cutting edge is active. Thus, such a linear grinding member can maintain grinding performance. A linear grinding member having a rectangular cross-sectional shape also has an edge effect because it is hard to bend in a direction along the long sides and the diagonal directions of the cross section. Furthermore, a linear grinding member having a rectangular cross-sectional shape has different degrees of easiness to bend in the thickness direction and width direction of the cross-section, and consequently makes irregular motions during processing. Thus, a linear grinding member having a rectangular cross-sectional shape provides increased grinding performance because it makes irregular motions and has an edge effect at the same time. Also in the present invention, a linear grinding member having an elliptical cross-sectional shape has a cross section thinner in the thickness direction than in the width direction (a direction along the major axis). Therefore, the front end thereof easily breaks, and the self-sharpening action for generating a new cutting edge actively works. Thus, such a linear grinding member can maintain grinding performance. A linear grinding member having an elliptical cross-sectional shape also has an edge effect because it is hard to bend in a direction along the major axis of the cross section. Furthermore, a linear grinding member having an elliptical cross-sectional shape has different degrees of easiness to bend in the thickness direction and width direction of the cross-section, and consequently makes irregular motions during processing. Thus, a linear grinding member having an elliptical cross-sectional shape provides increased grinding performance because it makes irregular motions and has an edge effect at the same time. Note that, during processing of a workpiece, the tip of a linear grinding member provides a process similar to grinding. For this reason, "polishing" and "grinding" are used without distinction therebetween in the present specification.

[0011] The present invention employs a linear grinding member having a rectangular or elliptical cross-sectional shape and having an aspect ratio in the range of 1.1 to 5.0. It has been found that, when having an aspect ratio in the range of 1.1 to 5.0, a linear grinding member is less likely to bend in a direction along the long sides or the major axis of the cross section and exerts an edge effect. An aspect ratio is a value obtained by dividing a dimension of the long side or the major axis by a dimension of the short side or the minor axis. Here, an adjustment such as increasing the aspect ratio for higher grinding performance or decreasing the aspect ratio for lower grinding performance can be made. Note that the surface roughness of a workpiece after processing tends to be rougher when processing efficiency is increased with the aspect ratio increased, and tends to be finer when processing efficiency is decreased with the aspect ratio decreased.

[0012] In the present invention, the composite yarn have been twisted. With the composite yarn appropriately twisted, longitudinal cracks (cracks in the lengthwise direction of the linear grinding member) in the linear grinding member can be prevented, and impactive wear can be prevented.

[0013] For a linear grinding member that has a rectangular or elliptical cross-sectional shape, a length dimension of the linear grinding member corresponding to one turn of twisting is set in the range of 1 cm to 4 cm when the aspect ratio is in the range of 1.1 to 1.9, and is set in the range of 10 cm to 20 cm when the aspect ratio is in the range of 2.0 to 5.0. When the aspect ratio is set in the range of 1.1 to 1.9, the effect of preventing longitudinal cracks of the linear grinding member can be obtained with the length dimension of the linear grinding member corresponding to one turn of twisting set to 4 cm or less. With the length dimension of the linear grinding member corresponding to one turn of twisting set to 1 cm or more, the inorganic filaments can be prevented from fuzzing because of the twisting. When the aspect ratio is in the range of 2.0 to 5.0, the effect of preventing longitudinal cracks of the linear grinding member can be obtained with the length dimension of the linear grinding member corresponding to one turn of twisting set to 20 cm or less, even for the linear grinding member that has a large aspect ratio of 2.0 or higher. With the length dimension of the linear grinding member corresponding to one turn of twisting set to 10 cm or more, the inorganic filaments can be prevented from fuzzing because of the twisting, even for the linear grinding member that has a large aspect ratio of 2.0 or higher.

[0014] Next, a brush-like grinding stone according to the present invention includes: a plurality of linear grinding members according to claim 1; a holder that holds the plurality of linear grinding members in the form of a bundle. In the brush-like grinding stone, each of the linear grinding members is obtained by stiffening a composite yarn including inorganic filaments, and each of the linear grinding members has a rectangular, or elliptical cross-sectional shape.

[0015] According to the present invention, each of the multiple linear grinding members has an edge effect, and provides high grinding performance, which makes it easier to process a workpiece with the brush-like grinding stone.

[0016] Furthermore, the present invention provides a method of manufacturing a linear grinding according to claim 3.

[0017] According to the present invention, when a linear grinding member is manufactured, the shaping step of passing the composite yarn impregnated with the resin binder through a die to shape the cross-sectional shape of the composite yarn is performed after the composite yarn is impregnated with the uncured resin binder in the impregnation step, and before or in parallel with the resin binder is cured in the resin-curing step. Thus, the cross-sectional shape of the linear grinding member can be easily controlled.

[0018] In the present invention, a twisting step of twisting the composite yarn is performed before the impregnation step. This step causes the inorganic filaments in the composite yarn to tangle together as a result of the twisting of the composite yarn, thereby making it easier to control the cross-sectional shape of the linear grinding member than in a case where the inorganic filaments extend parallel to one another. Appropriately twisting the composite yarn can prevent longitudinal cracks in the linear grinding member (cracks in the lengthwise direction of the linear grinding member), and can prevent impactive wear.

[0019] Another aspect of the present invention provides a method of manufacturing a linear grinding member according to claim 4.

[0020] According to the present invention, thus polishing the outer peripheral surface of the composite yarn makes it easier to shape the cross-sectional shape of the linear grinding member.

Brief Description of Drawing

[0021]

Fig. 1 is an illustration of a brush-like grinding stone according to a first example not according to the present invention.

Fig. 2 is an illustration of a brush-like grinding stone according to a second example of the present invention.

Fig. 3 is an illustration of a brush-like grinding stone according to a third example of the present invention.

Fig. 4 is an illustration schematically depicting a linear grinding member of the first example not according to the present invention.

Fig. 5 is an illustration of twisting of a composite yarn for a linear grinding member.

Fig. 6 is an illustration schematically depicting a linear grinding member of the second example according to the present invention.

Fig. 7 is an illustration schematically depicting a linear grinding member of the third example according to the present invention.

Fig. 8 is an illustration depicting a method for manufacturing a linear grinding member of the first example not according to the present invention.

Fig. 9 is an illustration depicting a method for manufacturing a linear grinding member of the second example of the present invention.

Description of Embodiments

[First Example of Brush-like Grinding Stone]

(Entire structure of polishing machine brush)

[0022] Fig. 1 is an illustration of a brush-like grinding stone according to a first example not according to the present invention. A polishing machine brush 10 illustrated in Fig. 1 is a tool for, for example, deburring and polishing a surface of a metal workpiece, and includes: a brush-like grinding stone 1; a brush case 2 that holds this brush-like grinding stone 1; and a fixing screw 3 for fixing the brush-like grinding stone 1 to the brush case 2.

[0023] The brush-like grinding stone 1 includes: a plurality of linear grinding members 11; and a holder 12 that holds respective base-end parts of the linear grinding members 11. The plurality of linear grinding members 11 are held by the holder 12 in the form of a plurality of bundles 110 each includes the multiple linear grinding members 11. The bundles 110 are arranged at uniform angle intervals around the rotational center axis line L of the polishing machine brush 10.

[0024] The linear grinding member 11 is obtained by impregnating a collection of inorganic filaments with binder resin and then forming the conglomerate into a linear shape. Examples of the inorganic filaments include alumina fiber filaments. Examples of the binder resin include: thermosetting resin such as epoxy resin and phenolic resin; silicone resin; and thermoplastic resin such as polyester resin, polypropylene resin, and polyamide resin. A composite yarn is obtained by gathering, for example, 250 to 3000 alumina fiber filaments (inorganic filaments) each having a filament diameter of 8 to 50 μm. The diameter of the composite yarn is 0.1 mm to 2 mm. Correspondingly, the linear grinding member 11 has a diameter equal to that of the composite yarn, which is 0.1 mm to 2 mm. A material for the inorganic filaments is not particularly limited as long as the material has a polishing property effective, in a relative sense, for a material to be polished, i.e., as long as the material is harder and more brittle than a material to be polished. Other than alumina fiber, usable examples include silicon carbide fiber, boron fiber, and glass fiber. Any ones of the above materials may be used in combination depending on a material to be polished. Alumina fiber and silicon carbide fiber have polishing properties that are very effective for ferrous metals and non-ferrous metals, respectively.

[0025] The holder 12 is made of metal or resin, and has a columnar outer shape. Alternatively, the holder 12 may have an outer shape like a quadrangle prism. At one end side of the holder 12, a cylindrical grinding material holding portion 12a that opens in the axis line direction is formed. The base end sections of the bundles 100 of the linear grinding members 11 are inserted into the grinding material holding portion 12a, and are glued and fixed thereto, whereby the linear grinding member 11 and the holder 12 are integrally joined together.

[0026] The brush case 2 includes a cylindrical circumferential wall part 21 having a bottom, and a driving connecting shaft 22 extended from one end side of the circumferential wall part 21 in a direction along a central axis line (a rotational center axis line L) of the circumferential wall part 21. The inner diameter dimension of the circumferential wall part 21 is slightly larger than the outer diameter dimension of the holder 12. In this embodiment, the brush case 2 is made of metal or resin. The driving connecting shaft 22 is used for attaching the polishing machine brush 10 to a polishing apparatus, and rotation driving force is transmitted to the polishing machine brush 10 via the driving connecting shaft 22, thereby bringing polishing actions into operation. Normally, the polishing machine brush 10 is driven so as to rotate about the rotational center axis line L. However, the movement thereof is not limited to rotation, and may be a reciprocating movement, an oscillation movement, swinging, or a combination of any ones of these movements may be made.

(Structure for fixing brush-like grinding stone to brush case)

[0027] In this embodiment, for fixing the brush-like grinding stone 1 to the brush case 2 by the fixing screw 3, one opening section 21a is formed in the circumferential wall part 21 of the brush case 2. The opening section 21a is formed like a slotted hole and extends in the axial direction. Additionally, the inner circumferential surface of the circumferential wall part 21 has a flat surface (not illustrated) formed on a region thereof opposite to the opening section 21a across the rotational center axis line L. The flat surface extends in the axial direction. The circumferential wall part 21 also has a thin-walled section

21c having a smaller thickness than the other portion thereof. This thin-walled section 21c has a shape obtained by thinly and flatly scraping a part of the outer circumferential surface of the circumferential wall part 21 for a predetermined length in the axial direction. In this embodiment, two thin-walled sections 21c are formed on opposite sides of a position that is opposite from the opening section 21a across the rotational center axis line L. Consequently, the center of gravity of the brush case 2 is located on the rotational center axis line L because the circumferential wall part 21 has the two thin-walled sections 21c and the flat surface formed thereon while having the opening section 21a formed therein.

[0028] In the upper end part of the holder 12, a screw hole 12b is drilled therethrough passing the rotational center axis line L and perpendicularly to the rotational center axis line L. The screw hole 12b is a part to which fixing screw 3 is fixed by being screwed thereinto when the brush-like grinding stone 1 is assembled to the brush case 2. In this embodiment, a hexagon socket set screw is used as the fixing screw 3, and the fixing screw 3 has a hexagon socket 31 formed on an end thereof. The hexagon socket 31 is a part into which the head of a hexagon wrench 5 is fitted.

[0029] The brush-like grinding stone 1 and the polishing machine brush 10, which are thus structured, are rotated about the rotational center axis line L with the tips of the linear grinding members 11 pressed against a workpiece, thereby removing burrs generated during molding or processing, or polishing the surface of the workpiece. The workpiece is, for example, a magnesium or aluminum die-cast product. Otherwise, the workpiece may be a steel member processed with such a tool as an end mill, a drill, a die, or a tap.

(Method for assembling polishing machine brush, and method for adjusting projection dimension of linear grinding member)

[0030] When the brush-like grinding stone 1 is assembled to the brush case 2 and fixed by the fixing screw 3, the brush-like grinding stone 1 is inserted into the brush case 2 from the side of the holder 12. Thereafter, the brush-like grinding stone 1 is slid in the axial direction inside the brush case 2, so that a position of the assembly is adjusted to make the free end parts of the linear grinding members 11 project by a desired length from an opening on one end side of the circumferential wall part 21. When the brush-like grinding stone 1 is thus slid, the position thereof is circumferentially adjusted during the sliding so that the opening of the screw hole 12b of the holder 12 can be seen through the opening section 21a formed in the brush case 2. Thus, access to the screw hole 12b provided in the holder 12 is allowed through the opening section 21a.

[0031] Subsequently, the fixing screw 3 is screwed into the screw hole 12b through the opening section 21a, and tightened up in a direction from the opening section 21a toward a deeper part of the screw hole 12b. The fixing screw 3 is a hexagon socket set screw, and is tightened up until it is completely buried inside the screw hole 12b. As a result, the front end portion 30 of the fixing screw 3 slightly projects from the screw hole 12b, and abuts on the flat surface formed on the inner circumferential surface of the brush case 2. Thus, the fixing screw 3 and the holder 12 are pressed to each other in the inside of the circumferential wall part 21 of the brush case 2 and in the radial direction thereof, so that the holder 12 is pressed and immobilized against the inner circumferential surface of the opening section 21a of the circumferential wall part 21. In this state, the base end section of the fixing screw 3 has been embedded in the screw hole 12b, and the fixing screw 3 does not at all project from the outer circumferential surface of the circumferential wall part 21.

[0032] When the polishing machine brush 10 thus having the brush-like grinding stone 1 completely fixed to the brush case 2 is used for polishing, the tip portions of the linear grinding members 11 are worn, and the projection dimension of the linear grinding members 11 is reduced. In this case, the fixing screw 3 is eased, and the holder 12 is then moved in the axial direction, so that the projection dimension of the linear grinding members 11 is adjusted to an appropriate dimension, which is, for example, several millimeters to several tens of centimeters. The fixing screw 3 is then tightened up again, so that the holder 12 is immobilized inside the brush case 2.

[Second Example of Brush-like Grinding Stone]

[0033] Fig. 2 is an illustration of a brush-like grinding stone according to a second example of the present invention. Note that the basic structure of a polishing machine brush of this example is the same as in the mode illustrated in Fig. 1. Hence, common reference signs are given to common components and descriptions thereof are omitted.

[0034] While the linear grinding members 11 are held by the holder 12 in the form of the bundles 110 in the brush-like grinding stone 1, a plurality of linear grinding members 11 is held by the holder 12 in the form of a single bundle 110 in this embodiment as illustrated in Fig. 2. Similarly to the aspect described with reference to Fig. 1, the brush-like grinding stone 1 and the polishing machine brush 10 that are thus structured are also rotated about the rotational center axis line L with the tips of the linear grinding members 11 pressed against a workpiece, thereby being used to remove burrs generated during molding or processing, or polish the surface of the workpiece.

[Third Example of Brush-like Grinding Stone]

[0035] Fig. 3 is an illustration of a brush-like grinding stone according to a third example of the present invention. Note that the basic structure of a polishing machine brush of this example is the same as in the mode illustrated in Fig. 1. Hence, common reference signs are given to common components and descriptions thereof are omitted.

[0036] The brush-like grinding stone 1 illustrated in Fig. 3 is a tool for removing burrs inside cross-holes, and includes a plurality of linear grinding members 11 held in the form of a bundle 110 by the holder 12. The holder 12 includes a driving connecting shaft 120 formed thereon that is extended in the rotational center axis line L, and the driving connecting shaft 120 is coupled to an electric-powered rotation driving apparatus or the like. Additionally, a portion extending from the holder 12 to the base of the bundle 110 of the linear grinding members 11 is covered with a heat-shrinkable tube 40.

[0037] The thus structured brush-like grinding stone 1 is used by having the bundle 110 of the linear grinding members 11 inserted into a cross-hole from the tip side thereof, and having the brush-like grinding stone 1 rotated about the rotational center axis line L while the above state is maintained. As a result, the linear grinding members 11 are widened radially outward, thereby being enabled to remove burrs generated in the cross-hole.

[Linear Grinding Member]

[0038] Here, the linear grinding members 11 used in the respective brush-like grinding stones 1 of the first example, the second example, and the first example are described. Fig. 4 is an illustration schematically depicting a structure of each of the linear grinding members 11 of the first example not according to the invention. Fig. 5 is an illustration that depicts a twisted state of a composite yarn included in the linear grinding member 11, where two inorganic filaments of the inorganic filaments composing the composite yarn are illustrated as a solid line and a two-dot chain line. Fig. 6 is an illustration schematically depicting a structure of each of the linear grinding members 11 of the second example to which the present invention is applied. Fig. 7 is an illustration schematically depicting a structure of each of the linear grinding members 11 of the third example to which the present invention is applied. Note that, in illustrating the cross sections of composite yarns 15 and the linear grinding members 11 with the inorganic filaments represented by respective circles 150 in Fig. 4, Fig. 6, and Fig. 7, the inorganic filaments are enlarged more than the composite yarns 15 and the linear grinding members 11, and the numbers thereof are illustratively smaller correspondingly. Although some of the circles 150 representing the inorganic filaments are therefore illustrated as being chipped off, there are no chipped-off inorganic filaments in the composite yarns 15 and the linear grinding members 11. For the linear grinding members 11 used in the brush-like grinding stones 1 of the first example, the second example, and the first example, a linear grinding member 11A having a square cross-sectional shape as illustrated as the first example, a linear grinding member 11B having a rectangular cross-sectional shape as illustrated as the second example, or a linear grinding member 11C having an elliptical cross-sectional shape as illustrated as the third example is used.

[First Example of Linear Grinding Member]

[0039] As illustrated in Fig. 4, the linear grinding member 11A in this example has a square cross-sectional shape in a direction perpendicular to the axis line thereof.

[0040] The linear grinding member 11A of this example not according to the invention is hard to bend and firm because of having the same dimension in the X and Y directions of the cross section. Hence, the linear grinding member 11A is suitable for polishing a surface with few irregularities, and a surface with no irregularities. Additionally, the linear grinding member 11A exhibits sufficiently high firmness when the projection dimension is long, therefore being suitable for removing burrs inside a cross-hole, which requires high firmness. Furthermore, since the linear grinding member 11A has the same level of easiness to bend in the X and Y directions of the cross section, the linear grinding member 11A makes regular motions during processing. Consequently, using the linear grinding member 11A enables processing to be less prone to scratches and to provide fine finish surface roughness. Thus, the linear grinding member 11A is suitable for polishing, for example, surfaces for which finish surface roughness is important.

[0041] Additionally, the linear grinding member 11A exerts an edge effect because it is hard to bend in the diagonal directions. The linear grinding member 11A exerts a high edge effect because it has right-angled corners. Thus, the linear grinding member 11A has excellent grindability.

[0042] Here, as illustrated in Fig. 5, the composite yarn 15 in the linear grinding member 11A may have been twisted. In this case, the composite yarn 15 in the linear grinding member 11A is twisted in such a manner that a length dimension S of the linear grinding member 11A corresponding to one turn of twisting is in the range of 1 cm to 4 cm. With the length dimension S of the linear grinding member 11A corresponding to one turn of twisting set to 4 cm or less, the effect of preventing longitudinal cracks of the linear grinding member 11A can be obtained. With the length dimension S of the linear grinding member 11A corresponding to one turn of twisting set to 1 cm or more, the inorganic filaments can be prevented from fuzzing because of the twisting.

[Second Example of Linear Grinding Member]

[0043] As illustrated in Fig. 6, the linear grinding member 11B in this example has a rectangular cross-sectional shape in a direction perpendicular to the axis line thereof.

[0044] In the linear grinding member 11B in this example, a dimension in the thickness direction T (a direction along the short sides) is smaller than a dimension in the width direction W (a direction along the long sides). Hence, the linear grinding member 11B is easy to bend in the thickness direction T, and is hard to break off. Thus, the linear grinding member 11B is suitable for deburring, for example, a surface having a lot of irregularities on a surface to be processed. Additionally, the linear grinding member 11B has a cross section thinner in the thickness direction than in the width direction. Therefore, the tip thereof easily breaks, and the self-sharpening action for generating a new cutting edge is active. Furthermore, clogging is unlikely to occur because the linear grinding member 11B is thin.

[0045] Additionally, the linear grinding member 11B has an edge effect because it is hard to bend in a direction along the long sides and the diagonal directions of the cross-section. The linear grinding member 11B further has a high edge effect because it has right-angled corners. Furthermore, the linear grinding member 11B makes irregular motions during processing since degrees of easiness to bend are different in the thickness direction and width direction of the cross section thereof. Thus, the linear grinding member 11B provides increased grinding performance because it makes irregular motions and has an edge effect at the same time. Therefore, the linear grinding member 11B easily adapts to irregularities on a workpiece, thus being suitable for deburring and surface polishing where excellent grindability is desired.

[0046] An aspect ratio (a value obtained by dividing a dimension in the width direction W by a dimension in the thickness direction T) of the linear grinding member 11B is in the range of 1.1 to 5.0. More specifically, it has been found that, when having an aspect ratio in the range of 1.1 to 5.0, the linear grinding member 11B is less likely to bend in a direction along the long sides of the cross section and exerts an edge effect. Here, the aspect ratio set in the range of 2.0 to 5.0 is highly effective for the activeness of the self-sharpening action, the degree of clogging prevention, the irregularity of motions during processing, and the edge effect. Alternatively, the aspect ratio set in the range of 1.1 to 1.9 slightly reduces the activity level of the self-sharpening action and the degree clogging prevention; however, it results in relatively regular motions during processing, so that a surface finished with fine surface roughness is obtained.

[0047] Note that an adjustment such as increasing the aspect ratio for higher grinding performance or decreasing the aspect ratio for lower grinding performance can be made. However, the surface roughness of a workpiece after processing tends to be rougher when processing efficiency is increased with the aspect ratio increased, and tends to be finer when processing efficiency is decreased with the aspect ratio decreased.

[0048] Here, as illustrated in Fig. 5, the composite yarn 15 in the linear grinding member 11B may have been twisted. When the aspect ratio of the linear grinding member 11B is in the range of 1.1 to 1.9, the composite yarn 15 is twisted in such a manner that a length dimension S of the linear grinding member 11B corresponding to one turn of twisting is in the range of 1 cm to 4 cm. With the length dimension S of the linear grinding member 11B corresponding to one turn of twisting set to 4 cm or less, the effect of preventing longitudinal cracks of the linear grinding member 11B can be obtained. With the length dimension S of the linear grinding member 11B corresponding to one turn of twisting set to 1 cm or more, the inorganic filaments can be prevented from fuzzing because of the twisting.

[0049] Otherwise, when the aspect ratio of the linear grinding member 11B is in the range of 2.0 to 5.0, the length dimension S of the linear grinding member 11B corresponding to one turn of twisting is set in the range of 10 cm to 20 cm. With the length dimension S of the linear grinding member 11B corresponding to one turn of twisting set to 20 cm or less, the effect of preventing longitudinal cracks of the linear grinding member 11B can be obtained. With the length dimension S of the linear grinding member 11B corresponding to one turn of twisting set to 10 cm or more, the inorganic filaments can be prevented from fuzzing because of the twisting. More specifically, in the case of the linear grinding member 11B having a cross-sectional shape the aspect ratio of which is 2.0 or higher, twisting the composite yarn 15 more easily causes the inorganic filaments to fuzz in the thickness direction than in the case of the linear grinding member having a square cross-sectional shape. In this example, however, a length dimension of the linear grinding member 11B corresponding to one turn of twisting is set larger than that of the one having a square cross-sectional shape, which can prevent the inorganic filaments from fuzzing.

[Third Example of Linear Grinding Member]

[0050] As illustrated in Fig. 7, the linear grinding member 11C in this example has an elliptical cross-sectional shape in a direction perpendicular to the axis line thereof.

[0051] The linear grinding member 11C in this example has a dimension in the thickness direction T (a direction along the minor axis) smaller than a dimension in the width direction W (a direction along the major axis). Hence, the linear grinding member 11C easily bends in the thickness direction T, and is hard to break off. Thus, the linear grinding member 11C is suitable for deburring, for example, a surface having a lot of irregularities on a surface to be processed. Additionally, the linear grinding member 11C has a cross section thinner in the thickness direction than in the width direction. Therefore, the tip thereof easily breaks, and the self-sharpening action for generating a new cutting edge is active. Furthermore, clogging is unlikely to occur because the linear grinding member 11C is thin.

[0052] Additionally, the linear grinding member 11C has an edge effect because it is hard to bend in a direction along the major axis of the cross-section. Furthermore, the linear grinding member 11C has different degrees of easiness to bend in the thickness direction and width direction of the cross section, and consequently makes irregular motions during processing. Thus, the linear grinding member 11C provides increased grinding performance because it makes irregular motions and has an edge effect at the same time. Therefore, the linear grinding member 11C easily adapts to irregularities on a workpiece, thus being suitable for deburring and surface polishing where excellent grindability is desired.

[0053] An aspect ratio (a value obtained by dividing a dimension in the width direction W by a dimension in the thickness direction T) of the linear grinding member 11C is in the range of 1.1 to 5.0. More specifically, it has been found that, with the aspect ratio in the range of 1.1 to 5.0, the linear grinding member 11C is harder to bend in a direction along the major axis of the cross section and exerts an edge effect. Here, the aspect ratio set in the range of 2.0 to 5.0 is highly effective for the activeness of the self-sharpening action, the degree of clogging prevention, the irregularity of motions during processing, and the edge effect. The aspect ratio otherwise set in the range of 1.1 to 1.9 slightly reduces the activeness of the self-sharpening action and the degree of clogging prevention; however, it results in relatively regular motions during processing, so that a finished surface with fine surface roughness is obtained.

[0054] Furthermore, the linear grinding member 11C having an elliptical shape does not leaving damages such as scratches in processing of a workpiece because of having no corners in the cross section, and is therefore usable for, for example, surface polishing where fine surface roughness is desired.

[0055] Note that an adjustment such as increasing the aspect ratio for higher grinding performance or decreasing the aspect ratio for lower grinding performance can be made. However, the surface roughness of a workpiece after processing tends to be rougher when processing efficiency is increased with the aspect ratio increased, and tends to be finer when processing efficiency is decreased with the aspect ratio decreased.

[0056] Here, as illustrated in Fig. 5, the composite yarn 15 in the linear grinding member 11C may have been twisted. When the aspect ratio of the linear grinding member 11C is in the range of 1.1 to 1.9, the composite yarn 15 is twisted in such a manner that a length dimension S of the linear grinding member 11C corresponding to one turn of twisting is in the range of 1 cm to 4 cm. When the aspect ratio of the linear grinding member 11C is in the range of 2.0 to 5.0, the length dimension S of the linear grinding member 11C corresponding to one turn of twisting is in the range of 10 cm to 20 cm. In this manner, the same effects as those in the case of the linear grinding member 11B having a rectangular cross-sectional shape can be obtained.

[First Example of Method for Manufacturing Linear Grinding Member]

[0057] Fig. 8 is an illustration depicting a first example of a method for manufacturing a linear grinding member, where (a) and (b) of Fig. 8 illustrate an impregnation step and steps following the impregnation step.

[0058] In manufacturing the linear grinding member 11, firstly, the composite yarn 15 of inorganic filaments is impregnated with an uncured resin binder 16 in the impregnation step illustrated in (a) of Fig. 8. Examples of resin that can be used as the resin binder 16 include: thermosetting resin such as epoxy resin and phenolic resin; silicone resin; and thermoplastic resin such as polyester resin, polypropylene resin, and polyamide resin. In this embodiment, the composite yarn 15 is supplied in a state wound around a cylindrical or columnar bobbin 51, and the resin binder 16 has been reserved in a resin binder vessel 53. After being drawn out from the bobbin 51 while being wound up around a bobbin 52, the composite yarn 15 moves on while being guided by a guide member 54 such as a roller placed inside a resin binder container 53, and guide members 55 and 56 such as rollers placed outside the resin binder container 53. The composite yarn 15 is immersed with the resin binder 16 reserved in the resin binder container 53, thus being impregnated with the resin binder 16, before it is wound up around the bobbin 52. The composite yarn 15 impregnated with the resin binder 16 is wound around the bobbin 52 without overlapping itself.

[0059] As illustrated in (b) of Fig. 8, the impregnated composite yarn 15 wound around the bobbin 52 is then subjected to a shaping step where the cross-sectional shape thereof is shaped when passing through a die 61, and then subjected to a resin-curing step where the impregnated composite yarn 15 is put in a heating furnace 62 where the resin binder 16 is cured. As a result, the linear grinding member 11 having the composite yarn 15 of a plurality of inorganic filaments stiffened with the resin binder 16 is obtained. The thus obtained linear grinding member 11 is cut into pieces of a predetermined dimension after the resin-curing step. Alternatively, the linear grinding member 11 may be cut into pieces of a predetermined dimension after being wound around another bobbin (not illustrated).

[0060] Here, the die 61 has a passage (not illustrated) formed therein through which the impregnated composite yarn 15 passes, and the passage opens at opposite end surfaces of the die 61. Hence, opening sections 610 of the passage are provided in the end surfaces of the die 61, and, when passing through the die 61, the composite yarn 15 is shaped so that the cross-sectional shape thereof can be a shape corresponding to the shape of the passage and the opening sections 610. As a result, the linear grinding member 11 having a cross-sectional shape corresponding to the shape of the passage of the die 61 and the opening sections 610 is obtained.

[0061] More specifically, when the shape of the opening sections 610 is square, the linear grinding member 11 (linear grinding member 11A) having a square cross-sectional shape is obtained as illustrated in Fig. 4. When the shape of the opening sections 610 is rectangular, the linear grinding member 11 (linear grinding member 11B) having a rectangular cross-sectional shape is obtained as illustrated in Fig. 6. Similarly, when the shape of the opening sections 610 is elliptical, the linear grinding member 11 (linear grinding member 11C) having an elliptical cross-sectional shape is obtained as illustrated in Fig. 7. Note that, in the die 61, the passage may be formed as any one of a through-hole and a groove that opens on a side surface of the die 61.

[0062] As described above, in this embodiment, when the linear grinding member 11 is manufactured, the cross-sectional shape of the composite yarn 15 is shaped in such a manner that: the composite yarn 15 is impregnated with the uncured resin binder 16 in the impregnation step; and thereafter the composite yarn 15 impregnated with the resin binder 16 is passed through the die 61 in the shaping step before the resin binder 16 is cured in the resin-curing step. Thus, the cross-sectional shape of the linear grinding member 11 can be easily controlled.

[Second Example of Method for Manufacturing Linear Grinding Member]

[0063] Fig. 9 is an illustration depicting a second example of a method for manufacturing a linear grinding member, where (a) and (b) of Fig. 9 illustrate an impregnation step and steps following the impregnation step. Note that the basic configuration of the mode illustrated in Fig. 9 is the same as in the mode described with reference to Fig. 8. Hence, common reference signs are given to common components and descriptions thereof are omitted.

[0064] In the method for manufacturing the linear grinding member 1 in this embodiment, when the linear grinding member 11 is manufactured, firstly, the composite yarn 15 of inorganic filaments is impregnated with the uncured resin binder 16 in the impregnation step illustrated in (a) of Fig. 9 as in the case of the impregnation step described with reference to (a) of Fig. 8. In this embodiment, the composite yarn 15 is supplied in a state wound around the cylindrical or columnar bobbin 51. Before being wound up around the bobbin 52, the composite yarn 15 is immersed with the resin binder 16 reserved in the resin binder container 53 to be impregnated with the resin binder 16.

[0065] Here, the bobbin 51 is provided with a drive unit 59 that rotates the bobbin 51 about an axis line P extending in a direction in which the composite yarn 15 is fed. When the impregnation step is performed, the drive unit 59 rotates the bobbin 51 about the axis line P synchronously with feeding of the composite yarn 15. Consequently, the composite yarn 15 is twisted as schematically illustrated in Fig. 5. The twisting is such that, when the linear grinding member 11 having a square cross-sectional shape as illustrated in Fig. 5 is manufactured, a length dimension S of the linear grinding member corresponding to one turn of twisting is set in the range of 1 cm to 4 cm. Otherwise, when the linear grinding member 11 having a rectangular or elliptical cross-sectional shape as illustrated in Fig. 6 or Fig. 7 is manufactured, a length dimension S of the linear grinding member corresponding to one turn of twisting is set in the range of 1 cm to 4 cm or 10 cm to 20 cm.

[0066] As illustrated in (b) of Fig. 9, the impregnated composite yarn 15 wound around the bobbin 52 is then subjected to a shaping step where the cross-sectional shape thereof is shaped when passing through a die 61, and then subjected to a resin-curing step where the impregnated composite yarn 15 is put in a heating furnace 62 where the resin binder 16 is cured. As a result, the linear grinding member 11 having the composite yarn 15 of a plurality of inorganic filaments stiffened with the resin binder 16 is obtained. This linear grinding member 11 is cut into pieces of a predetermined dimension after the resin-curing step. Alternatively, the linear grinding member 11 may be cut into pieces of a predetermined dimension after being wound around another bobbin (not illustrated).

[0067] Here, the die 61 has an opening section 610 through which the already impregnated composite yarn 15 passes, whereby, when passing through the die 61, the composite yarn 15 is shaped to have a cross-sectional shape corresponding to the shape of the opening section 610. As a result, the linear grinding member 11 having a square, rectangular or elliptical cross-sectional shape is obtained.

[0068] As described above, in this embodiment, when the linear grinding member 11 is manufactured, the cross-sectional shape of the composite yarn 15 is shaped in such a manner that: the composite yarn 15 is impregnated with the uncured resin binder 16 in the impregnation step; and thereafter the composite yarn 15 impregnated with the resin binder 16 is passed through the die 61 in the shaping step before the resin binder 16 is cured in the resin-curing step. Thus, the cross-sectional shape of the linear grinding member 11 can be easily controlled. Hence, the brush-like grinding stone 1 including linear grinding members each having a cross-sectional shape suitable for a purpose such as surface polishing or deburring of a cross-hole can be obtained.

[0069] According to the invention a twisting step of twisting the composite yarn 15 is performed before the impregnation step, and inorganic filaments become tangled in the composite yarn 15 as a result of the twisting of the composite yarn 15. Thus, it is easier to control the cross-sectional shape of the linear grinding member 11 than in a case where another composite yarn 15 in which the inorganic filaments extend parallel to one another is used.

[0070] Here, when the linear grinding member 11 has a square cross-sectional shape, a length dimension of the linear grinding member 11 corresponding to one turn of twisting is set in the range of 1 cm to 4 cm. Since the length dimension of the linear grinding member 11 corresponding to one turn of twisting is thus not more than 4 cm, effects of the twisting can be exerted. Additionally, the length dimension of the linear grinding member 11 corresponding to one turn of twisting is 1 cm or more, whereby the inorganic filaments can be prevented from fuzzing because of the twisting.

[0071] Otherwise, when the linear grinding member 11 has a rectangular or elliptical cross-sectional shape, a length dimension of the linear grinding member 11 corresponding to one turn of twisting is set in the range of 1 cm to 4 cm if the aspect ratio thereof is in the range of 1.1 to 1.9. With the length dimension S of the linear grinding member 11C corresponding to one turn of twisting set to 4 cm or less, the effect of preventing longitudinal cracks of the linear grinding member 11 can be obtained as in the case of the linear grinding member 11 that has a square cross-sectional shape. With the length dimension S of the linear grinding member 11C corresponding to one turn of twisting set to 1 cm or more, the inorganic filaments can be prevented from fuzzing because of the twisting, as in the case of the linear grinding member 11 that has a square cross-sectional shape.

[0072] Furthermore, when the linear grinding member 11 has a rectangular or elliptical cross-sectional shape, a length dimension of the linear grinding member 11 corresponding to one turn of twisting is set in the range of 10 cm to 20 cm if the aspect ratio thereof is in the range of 2.0 to 5.0. More specifically, for the linear grinding member 11 that has an aspect ratio of 2.0 or higher, a length dimension of the linear grinding member 11 corresponding to one turn of twisting is set larger than for the linear grinding member 11 that has a square cross-sectional shape. Hence, the inorganic filaments in the composite yarn 15 become tangled both in the thickness direction and in the width direction even when the aspect ratio is so large as 2.0 or higher. Thus, it is easier to control the cross-sectional shape of the linear grinding member 11 than in a case where another composite yarn 15 in which the inorganic filaments extend parallel to one another is used. Additionally, when the linear grinding member 11 having a rectangular or elliptical cross-sectional shape the aspect ratio of which is 2.0 or higher is twisted, the inorganic filaments tend to fuzz in the thickness direction. In this example, however, a length dimension of the linear grinding member 11 corresponding to one turn of twisting is set larger than that of another linear grinding member 11 having a square cross-sectional shape, which can prevent the inorganic filaments from fuzzing. In this embodiment, particularly for the linear grinding member 11 having a rectangular or elliptical cross-sectional shape the aspect ratio of which is 2.0 or higher, the length dimension of the linear grinding member 11 corresponding to one turn of twisting is not more than 20 cm, whereby effects of the twisting can be exerted. Additionally, the length dimension of the linear grinding member 11 corresponding to one turn of twisting is 10 cm or more, whereby the inorganic filaments can be prevented from fuzzing because of the twisting.

[0073] Note that, although the resin-curing step follows the shaping step in the first example and the second example, the shaping step and the resin-curing step may be concurrently performed with a heating unit provided to the die 61.

[0074] Additionally, each of the first example and the second example may further include, after the shaping step of shaping the cross-sectional shape of the composite yarn 15 by passing the composite yarn 15 through the die 61, a size adjustment step of cutting out the shaped linear grinding member into pieces having a cross-sectional shape of a predetermined size.

[Third Example of Method for Manufacturing Linear Grinding Member]

[0075] Although the cross-sectional shape of the composite yarn 15 is shaped by passing the composite yarn 15 through the die 61 in each of the first example and the second example, each of these examples may exclude the shaping step of passing the composite yarn 15 through the die 61 to shape the cross-sectional shape thereof, and include, after the impregnation step and the resin-curing step are continuously performed, a polishing shaping step of polishing an outer circumferential surface of the composite yarn 15 to shape the cross-sectional shape thereof into a square, rectangle, or ellipse.

Claims

1. A linear grinding member (11) comprising a composite yarn (15) including inorganic filaments that has been stiffened with a resin binder (16), wherein
the linear grinding member (11) has a rectangular or elliptical cross-sectional shape and an aspect ratio which is in a range of 1.1 to 5.0;
wherein the aspect ratio is the value obtained by dividing a dimension in the width direction (W) of the linear grinding member by a dimension in the thickness direction (T) of the linear grinding member; wherein
the composite yarn (15) has been twisted; and **characterised in that**
a length dimension (S) of the linear grinding member (11) corresponding to one turn of twisting is set in a range of 1 cm to 4 cm if the aspect ratio is in a range of 1.1 to 1.9, and is set in a range of 10 cm to 20 cm if the aspect ratio is in a range of 2.0 to 5.0.

2. A brush-like grinding stone (1) comprising:

   a plurality of linear grinding members (11) according to claim 1; and
   a holder (12) that holds the plurality of linear grinding members (11) in the form of bundles (110).

3. A method for manufacturing a linear grinding member (11) obtained by stiffening, with a resin binder

(16), a composite yarn (15) including inorganic filaments, the method comprising:

a twisting step of twisting the composite yarn (15);
subsequently an impregnation step of impregnating the composite yarn with an uncured resin binder;
a shaping step of passing the composite yarn impregnated with the resin binder through a die (61) to shape a cross-sectional shape of the composite yarn into a rectangle or ellipse with an aspect ratio which is in a range of 1.1 to 5.0; and
wherein the aspect ratio is the value obtained by dividing a dimension in the width direction (W) of the linear grinding member by a dimension in the thickness direction (T) of the linear grinding member; and
a resin-curing step of curing the resin binder (16) after the shaping step or in parallel with the shaping step;
wherein in the shaping step, a length dimension (S) of the linear grinding member (11) corresponding to one turn of twisting is set in a range of 1 cm to 4 cm if the aspect ratio is in a range of 1.1 to 1.9, and is set in a range of 10 cm to 20 cm if the aspect ratio is in a range of 2.0 to 5.0.

4. A method for manufacturing a linear grinding member (11) obtained by stiffening, with a resin binder (16), a composite yarn (15) including inorganic filaments, the method comprising:

a twisting step of twisting the composite yarn (15);
subsequently an impregnation step of impregnating the composite yarn (15) with an uncured resin binder (16);
a resin-curing step of curing the resin binder (16); and
a polishing shaping step of polishing an outer circumferential surface of the composite yarn to shape a cross-sectional shape of the composite yarn into a rectangle or ellipse with an aspect ratio which is in a range of 1.1 to 5.0;

wherein the aspect ratio is the value obtained by dividing a dimension in the width direction (W) of the linear grinding member by a dimension in the thickness direction (T) of the linear grinding member;
wherein in the polishing shaping step, a length dimension (S) of the linear grinding member (11) corresponding to one turn of twisting is set in a range of 1 cm to 4 cm if the aspect ratio is in a range of 1.1 to 1.9, and is set in a range of 10 cm to 20 cm if the aspect ratio is in a range of 2.0 to 5.0.

Patentansprüche

1. Lineares Schleifelement (11), umfassend ein Verbundgarn (15), beinhaltend anorganische Fäden, die mit einem Harzbindemittel (16) versteift wurden, wobei
das lineare Schleifelement (11) eine rechteckige oder elliptische Querschnittsform und ein Aspektverhältnis, das in einem Bereich von 1,1 bis 5,0 liegt, aufweist;
wobei das Aspektverhältnis der Wert ist, der durch Teilen einer Abmessung in der Breitenrichtung (W) des linearen Schleifelements durch eine Abmessung in der Dickenrichtung (T) des linearen Schleifelements erhalten wird; wobei
das Verbundgarn (15) verdrillt wurde; und
dadurch gekennzeichnet, dass
eine Längenabmessung (S) des linearen Schleifelements (11) entsprechend einer Umdrehung des Verdrillens in einem Bereich von 1 cm bis 4 cm eingestellt ist, wenn das Aspektverhältnis in einem Bereich von 1,1 bis 1,9 liegt, und in einem Bereich von 10 cm bis 20 cm eingestellt ist, wenn das Aspektverhältnis in einem Bereich von 2,0 bis 5,0 liegt.

2. Bürstenartiger Schleifstein (1), umfassend:

eine Vielzahl von linearen Schleifelementen (11) nach Anspruch 1; und
eine Haltevorrichtung (12), die die Vielzahl von linearen Schleifelementen (11) in der Form von Bündeln (110) hält.

3. Verfahren zum Herstellen eines linearen Schleifelements (11), erhalten durch Versteifen, mit einem Harzbindemittel (16), eines Verbundgarns (15), beinhaltend anorganische Fäden, wobei das Verfahren Folgendes umfasst:

einen Verdrillungsschritt des Verdrillens des Verbundgarns (15);
nachfolgend einen Imprägnierungsschritt des Imprägnierens des Verbundgarns mit einem nicht ausgehärteten Harzbindemittel;
einen Formungsschritt des Führens des mit dem Harzbindemittel imprägnierten Verbundgarns durch ein Drahtzieheisen (61), um eine Querschnittsform des Verbundgarns zu einem Rechteck oder einer Ellipse mit einem Aspektverhältnis, das in einem Bereich von 1,1 bis 5,0 liegt, zu formen; und
wobei das Aspektverhältnis der Wert ist, der durch Teilen einer Abmessung in der Breitenrichtung (W) des linearen Schleifelements durch eine Abmessung in der Dickenrichtung (T) des linearen Schleifelements erhalten wird; und
einen Harzaushärtungsschritt des Aushärtens des Harzbindemittels (16) nach dem Formungs-

schritt oder parallel zu dem Formungsschritt; wobei in dem Formungsschritt eine Längenabmessung (S) des linearen Schleifelements (11) entsprechend einer Umdrehung des Verdrillens in einem Bereich von 1 cm bis 4 cm eingestellt ist, wenn das Aspektverhältnis in einem Bereich von 1,1 bis 1,9 liegt, und in einem Bereich von 10 cm bis 20 cm eingestellt ist, wenn das Aspektverhältnis in einem Bereich von 2,0 bis 5,0 liegt.

4. Verfahren zum Herstellen eines linearen Schleifelements (11), erhalten durch Versteifen, mit einem Harzbindemittel (16), eines Verbundgarns (15), beinhaltend anorganische Fäden, wobei das Verfahren Folgendes umfasst:

einen Verdrillungsschritt des Verdrillens des Verbundgarns (15);
nachfolgend einen Imprägnierungsschritt des Imprägnierens des Verbundgarns (15) mit einem nicht ausgehärteten Harzbindemittel (16);
einen Harzaushärtungsschritt des Aushärtens des Harzbindemittels (16); und
einen Polierungs-Formungsschritt des Polierens einer äußeren Umfangsfläche des Verbundgarns, um eine Querschnittsform des Verbundgarns zu einem Rechteck oder einer Ellipse mit einem Aspektverhältnis, das in einem Bereich von 1,1 bis 5,0 liegt, zu formen;

wobei das Aspektverhältnis der Wert ist, der durch Teilen einer Abmessung in der Breitenrichtung (W) des linearen Schleifelements durch eine Abmessung in der Dickenrichtung (T) des linearen Schleifelements erhalten wird;
wobei in dem Polierungs-Formungsschritt eine Längenabmessung (S) des linearen Schleifelements (11) entsprechend einer Umdrehung des Verdrillens in einem Bereich von 1 cm bis 4 cm eingestellt ist, wenn das Aspektverhältnis in einem Bereich von 1,1 bis 1,9 liegt, und in einem Bereich von 10 cm bis 20 cm eingestellt ist, wenn das Aspektverhältnis in einem Bereich von 2,0 bis 5,0 liegt.

Revendications

1. Elément abrasif linéaire (11) comprenant un fil composite (15) comprenant des filaments inorganiques qui a été rigidifié avec un liant de résine (16),
ledit élément abrasif linéaire (11) possédant une forme transversale rectangulaire ou elliptique et un rapport de forme qui est compris dans une plage allant de 1,1 à 5,0 ;
ledit rapport de forme étant la valeur obtenue en divisant une dimension dans la direction de largeur (W) de l'élément abrasif linéaire par une dimension dans la direction d'épaisseur (T) de l'élément abrasif linéaire ;
ledit fil composite (15) ayant été tordu ; et
caractérisé en ce que
une dimension de longueur (S) de l'élément abrasif linéaire (11) correspondant à un tour de torsion est définie dans une plage allant de 1 cm à 4 cm si le rapport de forme est compris dans la plage allant de 1,1 à 1,9, et est définie dans une plage allant de 10 cm à 20 cm si le rapport de forme est compris dans la plage allant de 2,0 à 5,0.

2. Meule en forme de brosse (1) comprenant :

une pluralité d'éléments abrasifs linéaires (11) selon la revendication 1 ; et
un support (12) qui maintient la pluralité d'éléments abrasifs linéaires (11) sous la forme de faisceaux (110).

3. Procédé pour la fabrication d'un élément abrasif linéaire (11) obtenu en rigidifiant, avec un liant de résine (16), un fil composite (15) comprenant des filaments inorganiques, le procédé comprenant :

une étape de torsion comprenant la torsion du fil composite (15) ;
ensuite une étape d'imprégnation comprenant l'imprégnation du fil composite avec un liant de résine non durci ;
une étape de mise en forme comprenant le passage du fil composite imprégné du liant de résine à travers une filière (61) pour façonner une forme transversale du fil composite en un rectangle ou une ellipse avec un rapport de forme qui est compris dans une plage allant de 1,1 à 5,0 ; et
ledit rapport de forme étant la valeur obtenue en divisant une dimension dans la direction de largeur (W) de l'élément abrasif linéaire par une dimension dans la direction d'épaisseur (T) de l'élément abrasif linéaire ; et
une étape de durcissement de résine comprenant le durcissement du liant de résine (16) après l'étape de mise en forme ou en parallèle avec l'étape de mise en forme ;
dans l'étape de mise en forme, une dimension de longueur (S) de l'élément abrasif linéaire (11) correspondant à un tour de torsion étant définie dans une plage allant de 1 cm à 4 cm si le rapport de forme est compris dans une plage allant de 1,1 à 1,9, et étant définie dans une plage allant de 10 cm à 20 cm si le rapport de forme étant compris dans une plage allant de 2,0 à 5,0.

4. Procédé pour la fabrication d'un élément abrasif linéaire (11) obtenu en rigidifiant, avec un liant de résine (16), un fil composite (15) comprenant des filaments inorganiques, le procédé comprenant :

une étape de torsion comprenant la torsion du fil composite (15) ;
ensuite une étape d'imprégnation comprenant l'imprégnation du fil composite (15) avec un liant de résine non durci (16) ;
une étape de durcissement de résine comprenant le durcissement du liant de résine (16) ; et
une étape de mise en forme par polissage comprenant le polissage d'une surface circonférentielle externe du fil composite pour façonner une forme transversale du fil composite en un rectangle ou une ellipse avec un rapport de forme qui est compris dans une plage allant de 1,1 à 5,0 ;

ledit rapport de forme étant la valeur obtenue en divisant une dimension dans la direction de largeur (W) de l'élément abrasif linéaire par une dimension dans la direction d'épaisseur (T) de l'élément abrasif linéaire ;
dans l'étape de mise en forme par polissage, une dimension de longueur (S) de l'élément abrasif linéaire (11) correspondant à un tour de torsion étant définie dans une plage allant de 1 cm à 4 cm si le rapport de forme est compris dans une plage allant de 1,1 à 1,9 et étant définie dans une plage allant de 10 cm à 20 cm si le rapport de forme est compris dans une plage allant de 2,0 à 5,0.

Fig. 1

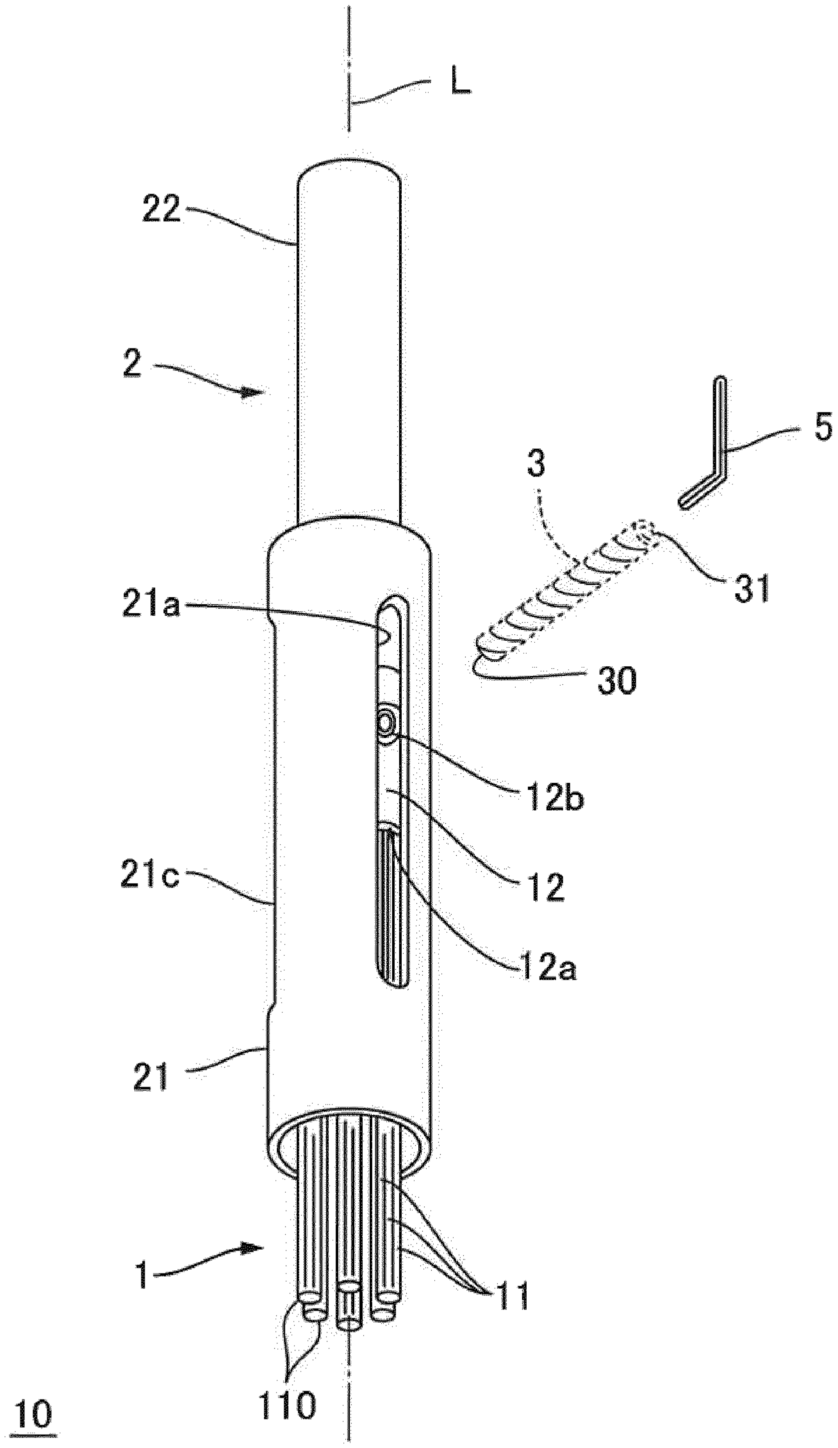


Fig. 2

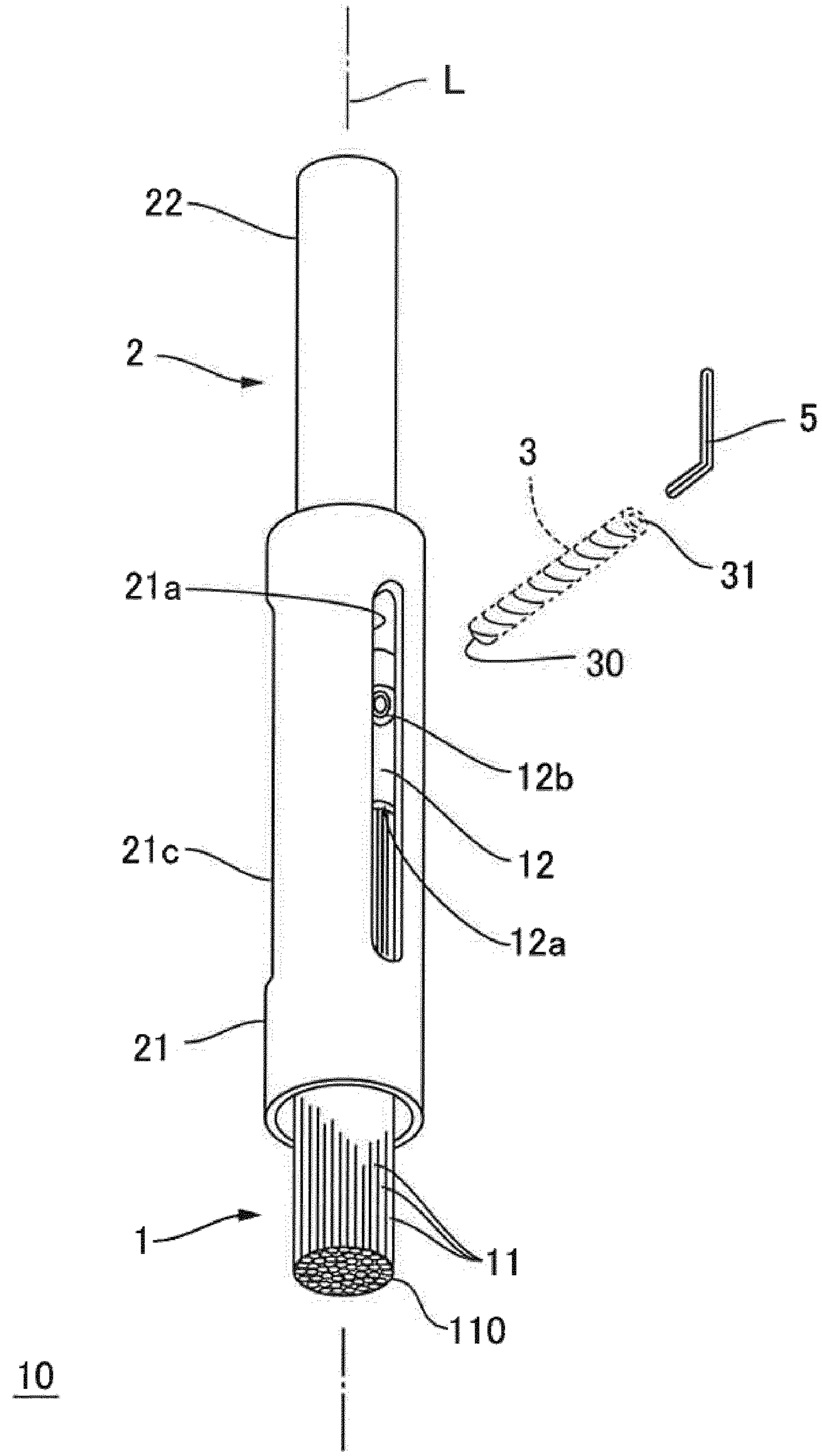


Fig. 3

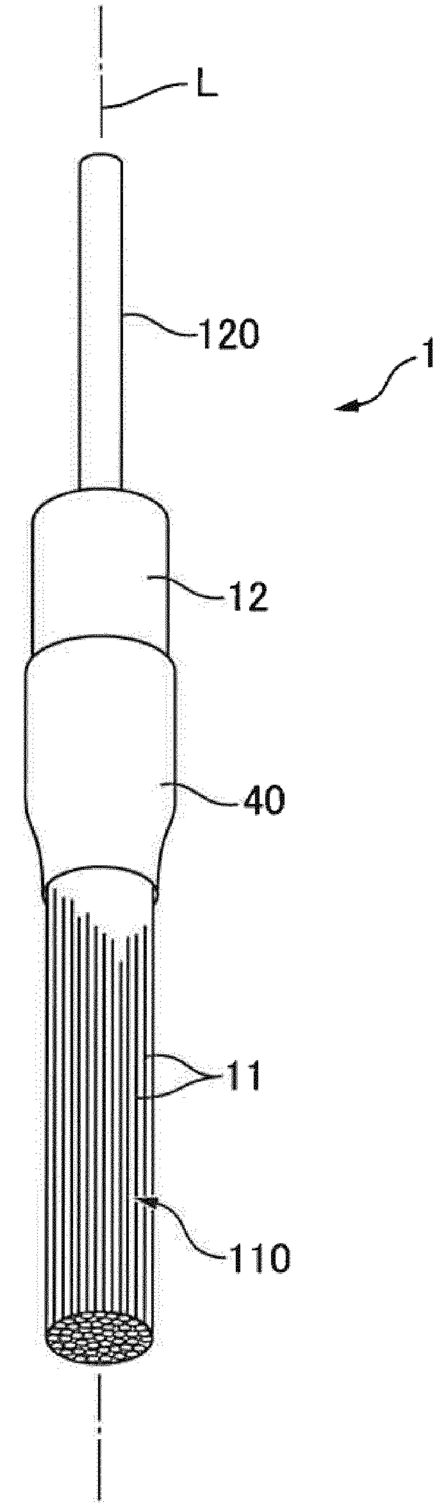


Fig. 4.

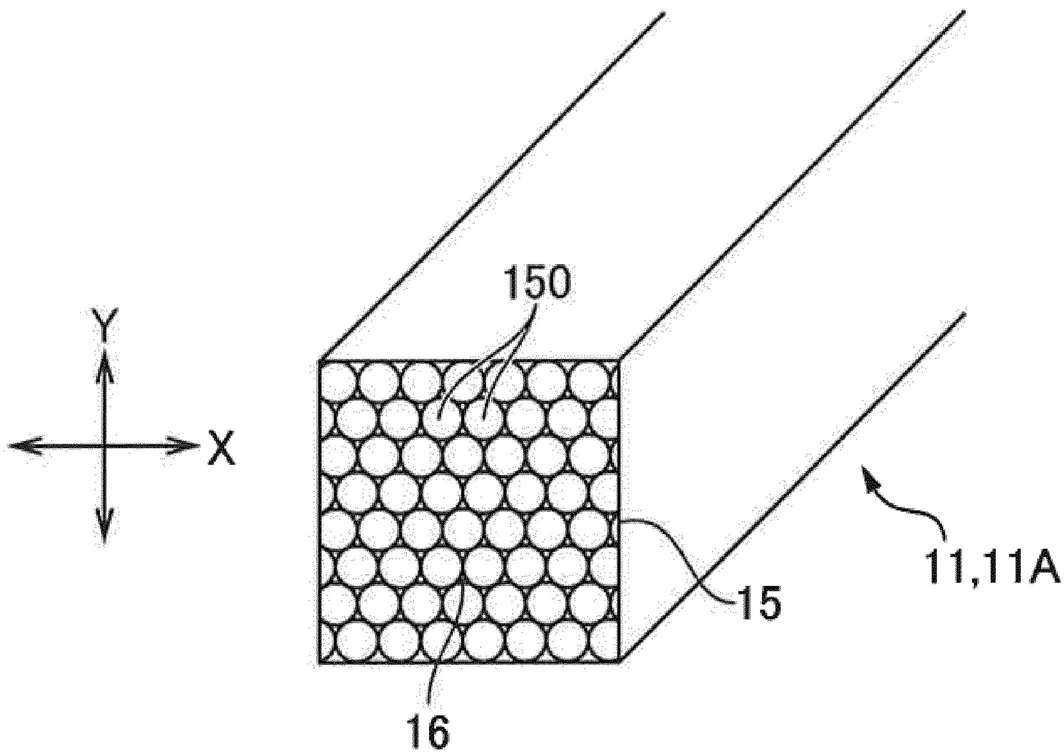


Fig. 5

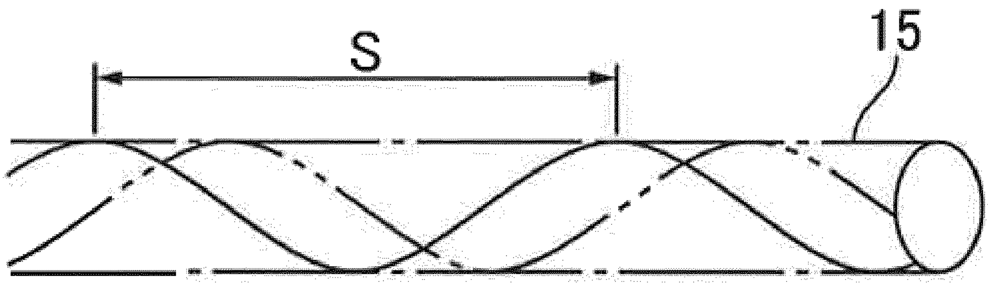


Fig. 6

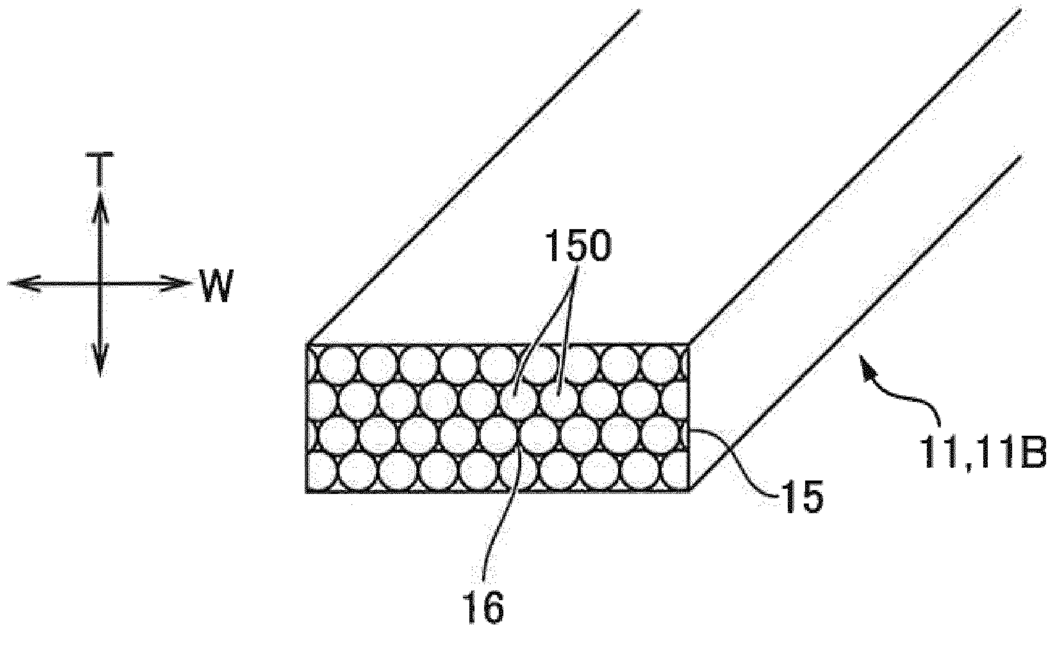


Fig. 7

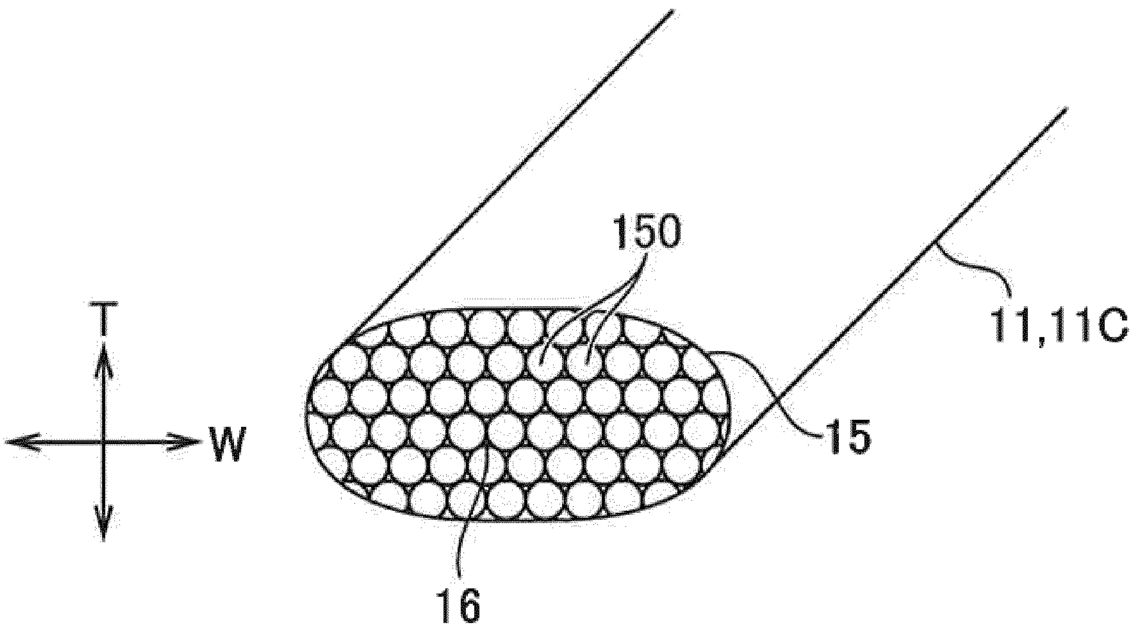


Fig. 8

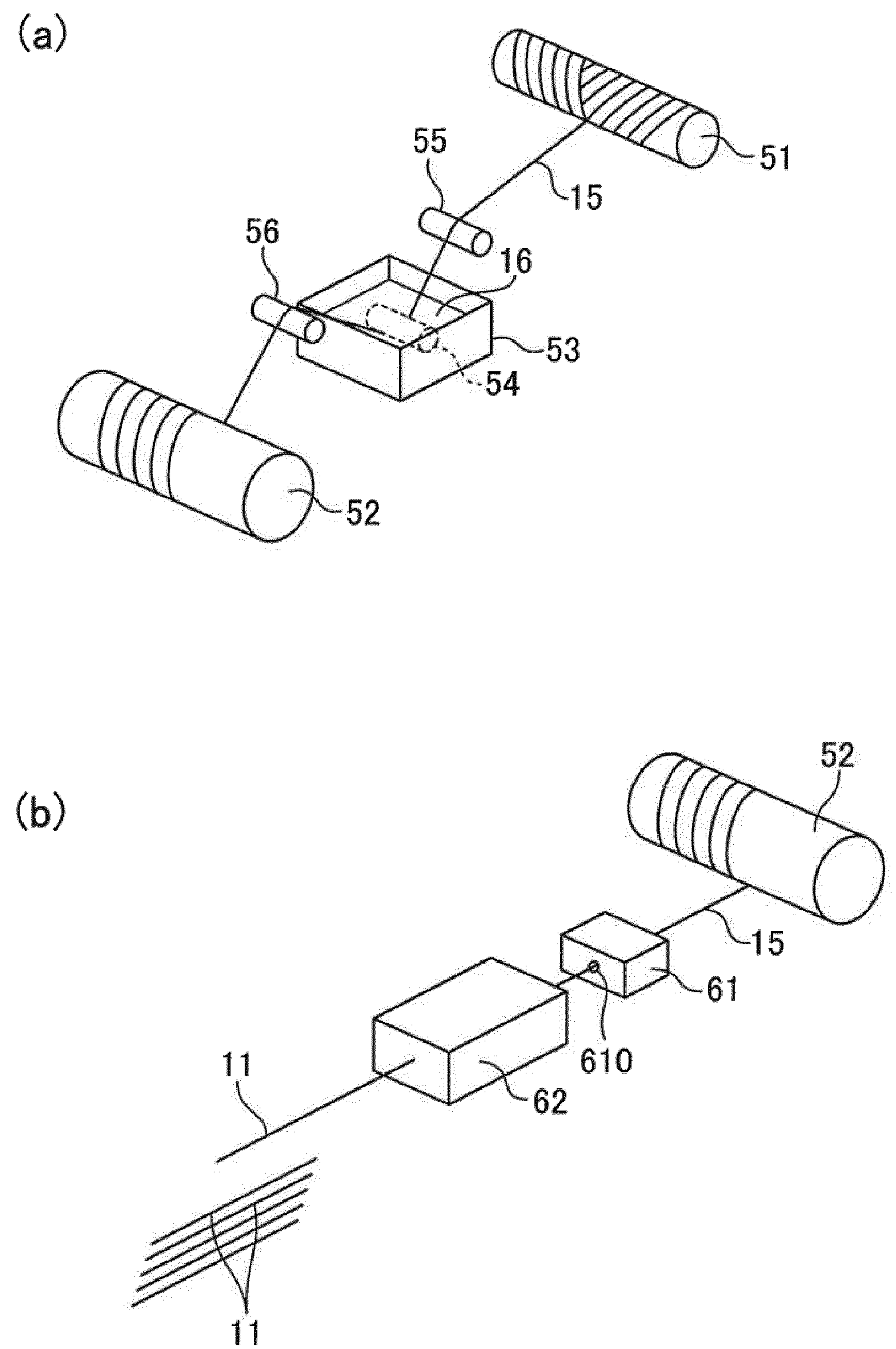
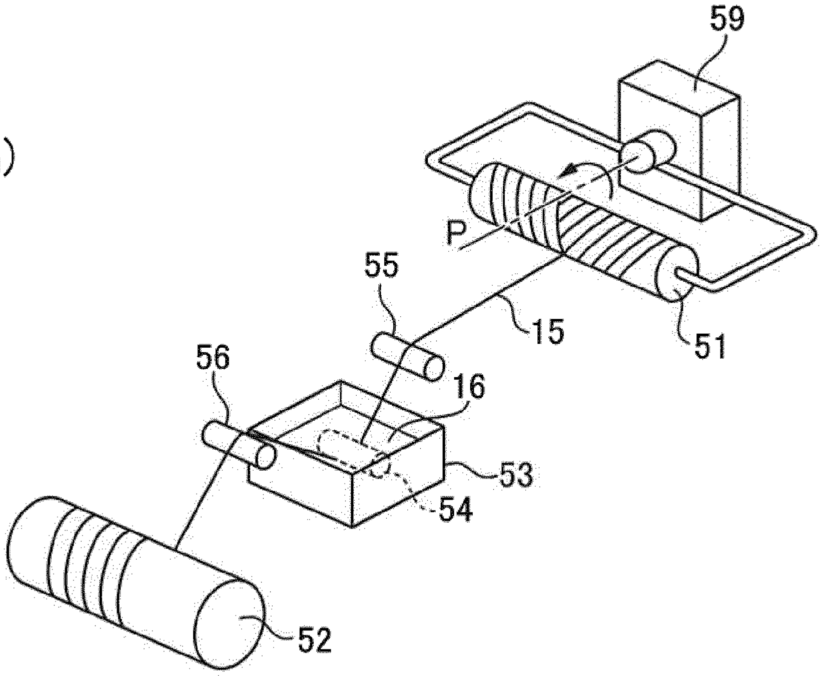
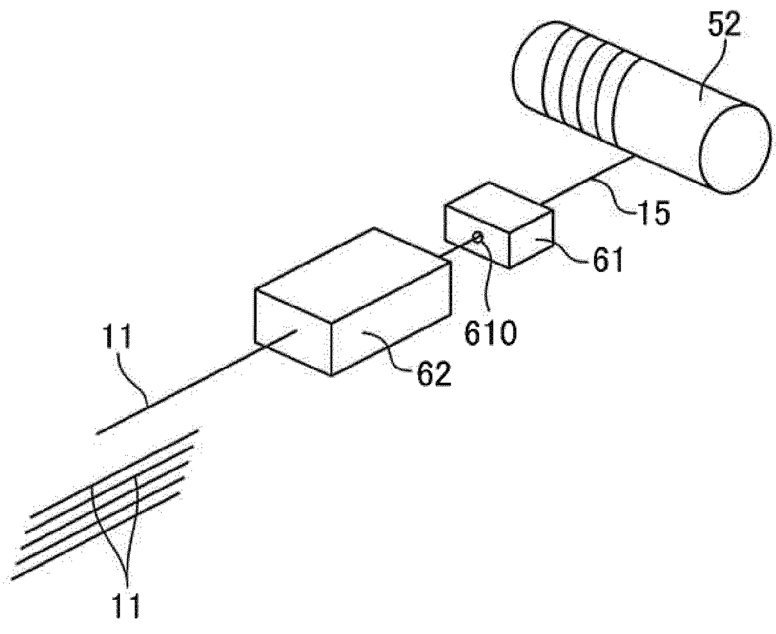


Fig. 9

(a)



(b)



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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