



US 20140041702A1

(19) **United States**(12) **Patent Application Publication**
Yamamoto et al.(10) **Pub. No.: US 2014/0041702 A1**(43) **Pub. Date: Feb. 13, 2014**(54) **CANE AND CYLINDRICAL BODY**(75) Inventors: **Tsutomu Yamamoto**, Shiga (JP);
Kazuhiko Kosuge, Tokyo (JP); **Akito Miyazaki**, Hyogo (JP); **Kouki Doi**, Kanagawa (JP)(73) Assignee: **KOSUGE & CO., LTD.**, Tokyo (JP)(21) Appl. No.: **13/984,001**(22) PCT Filed: **Oct. 20, 2011**(86) PCT No.: **PCT/JP2011/074183**§ 371 (c)(1),
(2), (4) Date: **Oct. 23, 2013**(30) **Foreign Application Priority Data**Feb. 9, 2011 (JP) 2011-026414
Sep. 29, 2011 (JP) 2011-213921**Publication Classification**(51) **Int. Cl.**
A45B 9/04 (2006.01)
A45B 9/00 (2006.01)(52) **U.S. Cl.**CPC **A45B 9/04** (2013.01); **A45B 9/00** (2013.01)USPC **135/77**; 428/36.4; 135/65(57) **ABSTRACT**

Provided is a cane that has a sufficient impact-resistant strength; and is excellent in safety, durability and repairability and also lightweight but has a high stiffness. Such a cane has a shaft (4) and a grip,

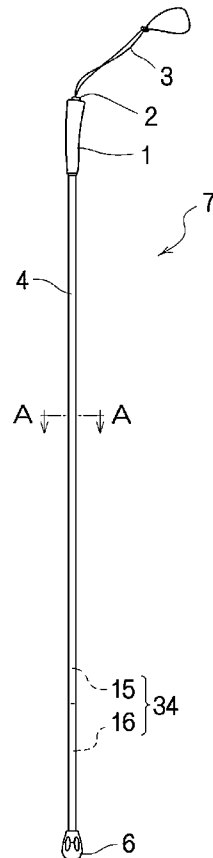
the shaft (4) comprising a high-strength-organic-fiber-reinforced-resin layer (31) and a carbon-fiber-reinforced-resin layer (32),

the high-strength-organic-fiber-reinforced-resin layer (31) being integrally laminated onto each of the outside and inside surfaces of the carbon-fiber-reinforced-resin layer (32),

the shaft (4) comprising a glass-fiber-reinforced-resin layer (33a) on the inner side of the innermost high-strength-organic-fiber-reinforced-resin layer (31a),

the shaft (4) comprising a glass-fiber-reinforced-resin layer (33b) on the outer side of the outermost high-strength-organic-fiber-reinforced-resin layer (31b).

(a)



(b)

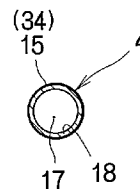
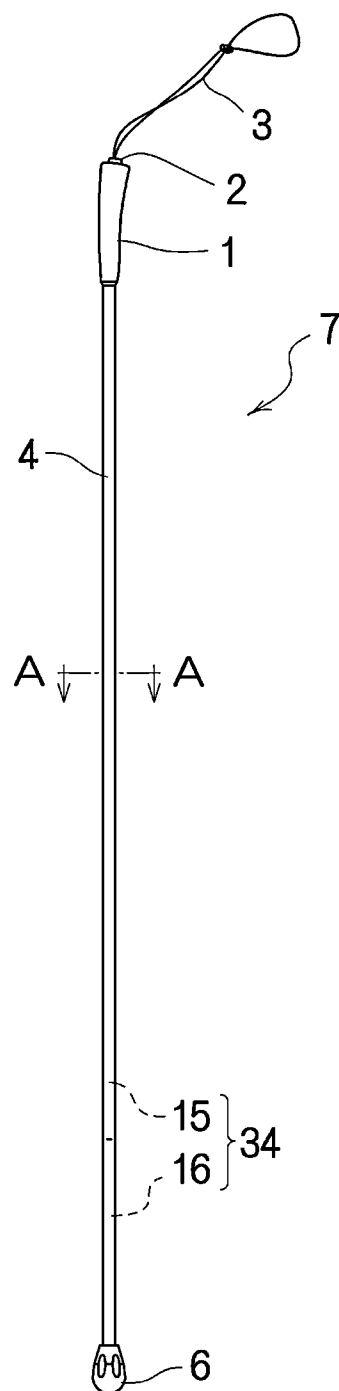


Fig. 1

(a)



(b)

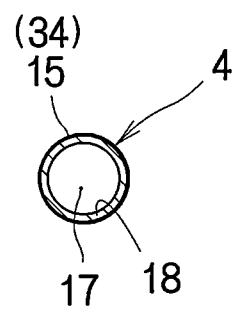


Fig. 2

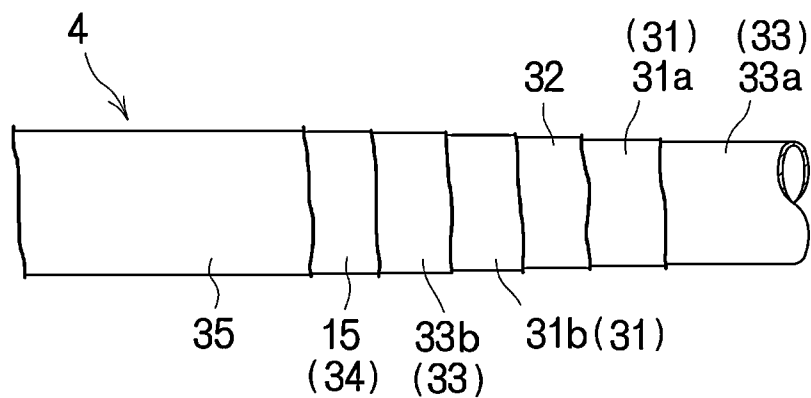


Fig. 3

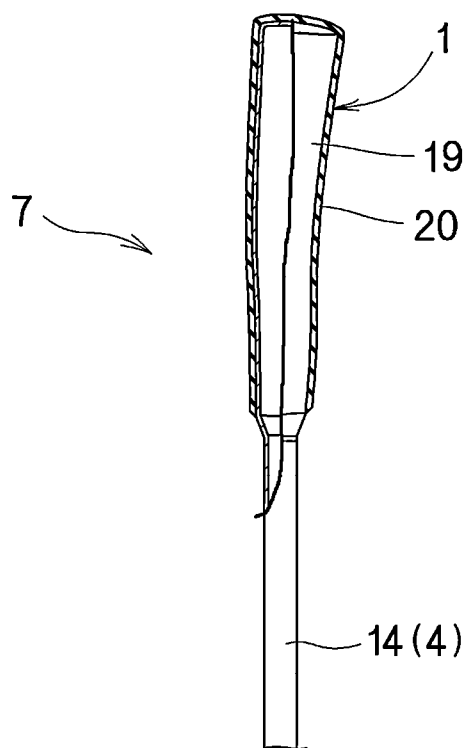


Fig. 4

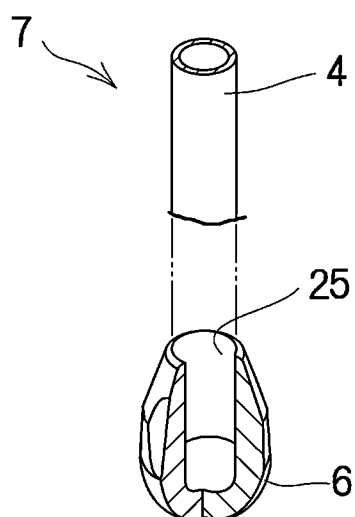


Fig. 5

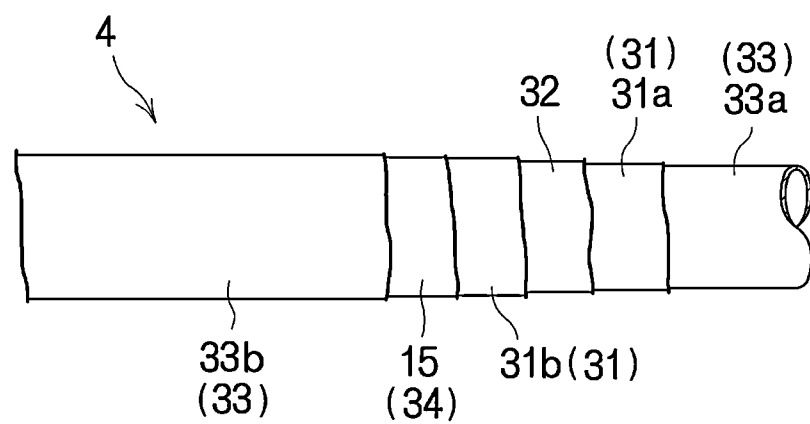


Fig. 7

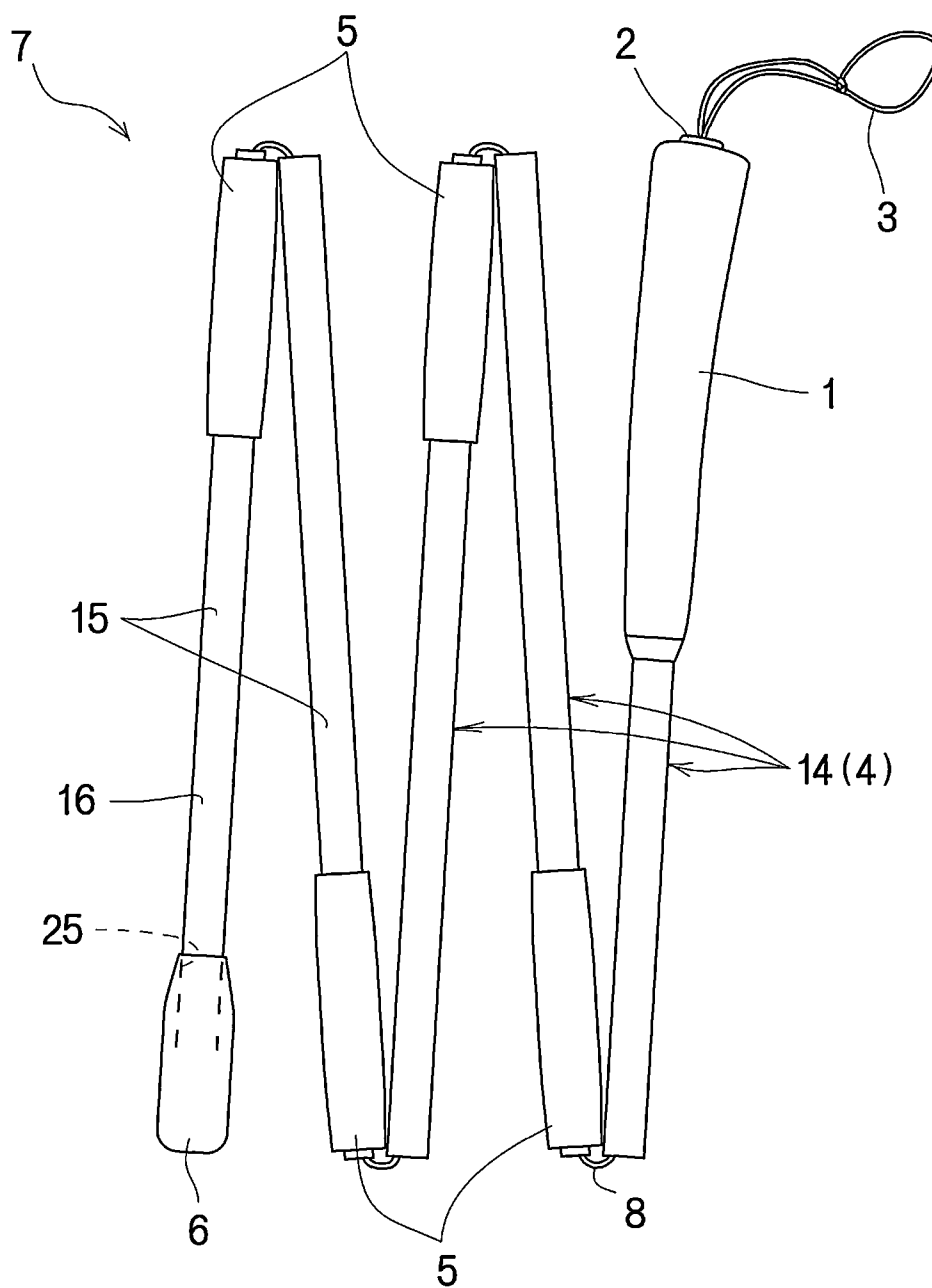


Fig. 8

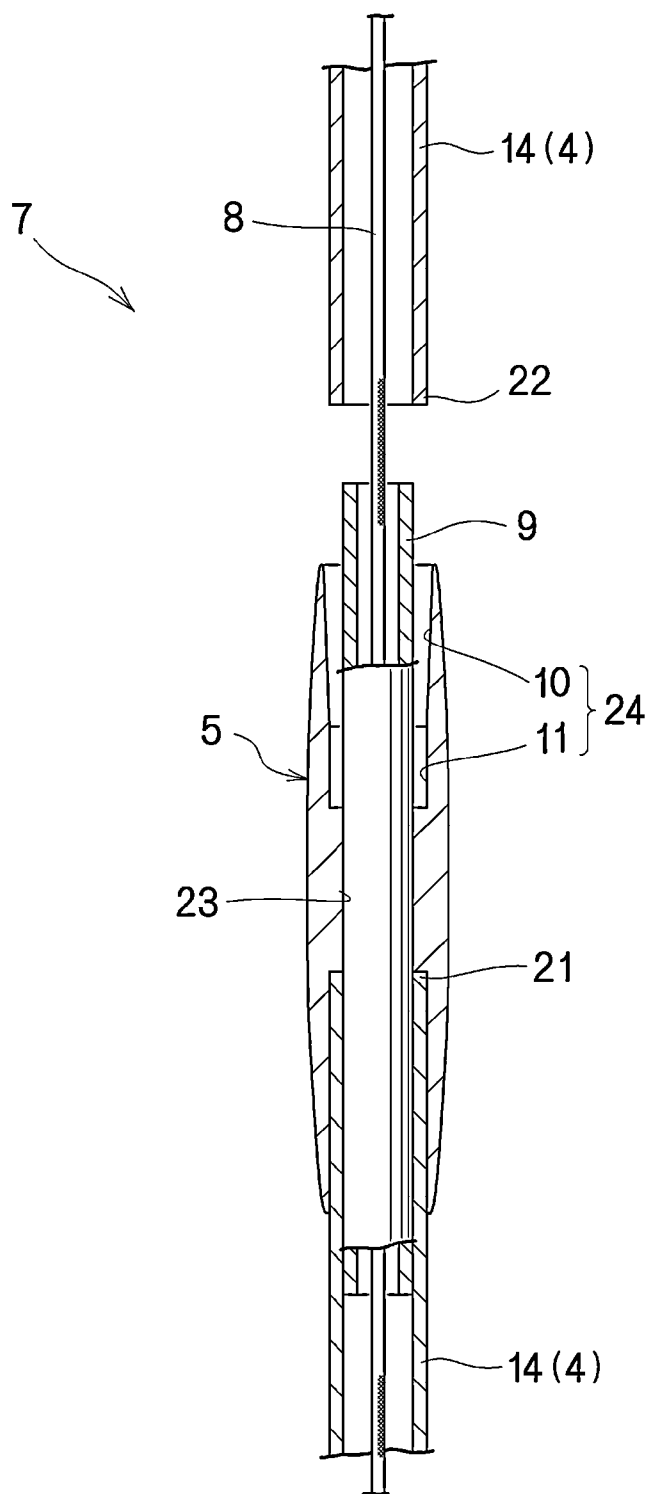


Fig. 9

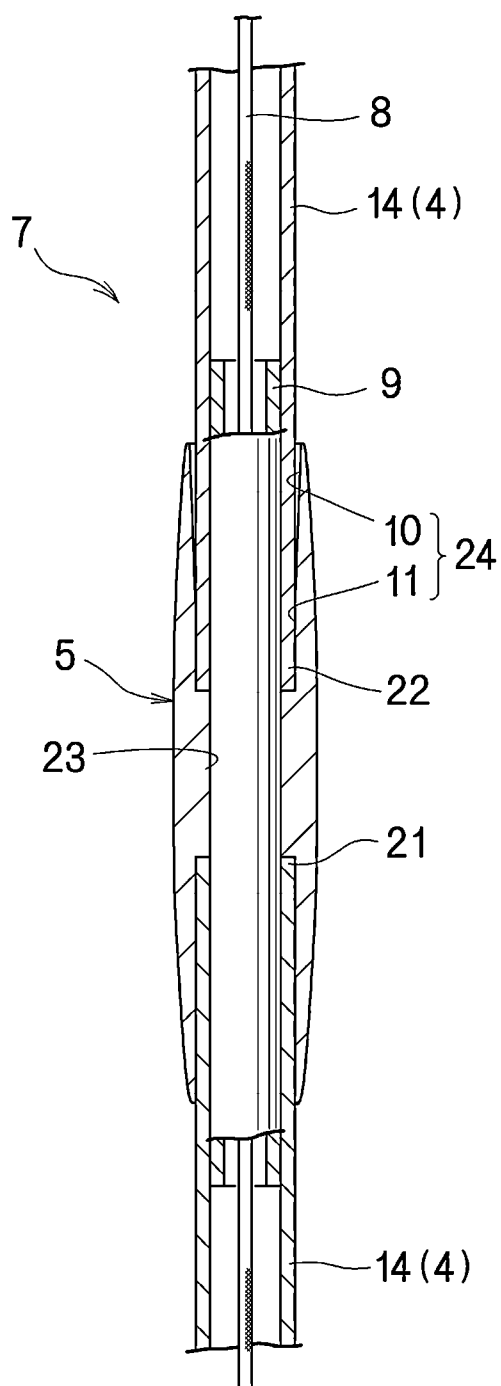


Fig. 10

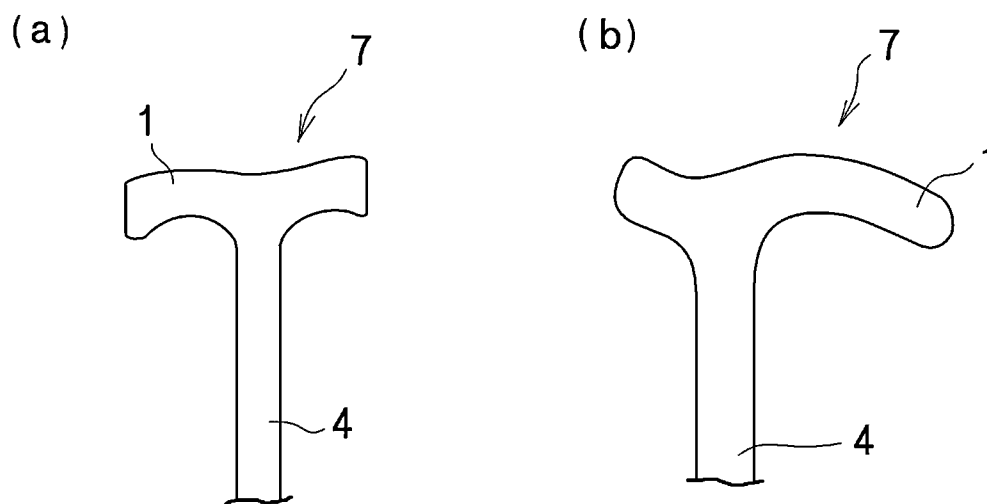


Fig. 11

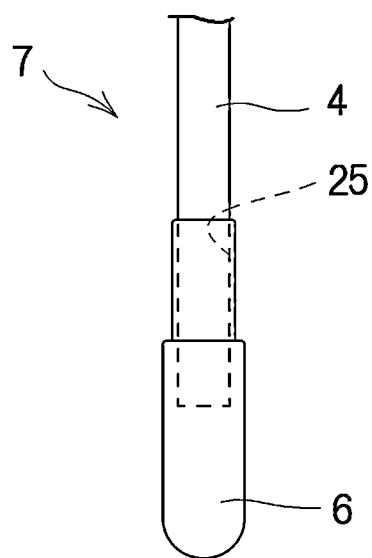


Fig. 12

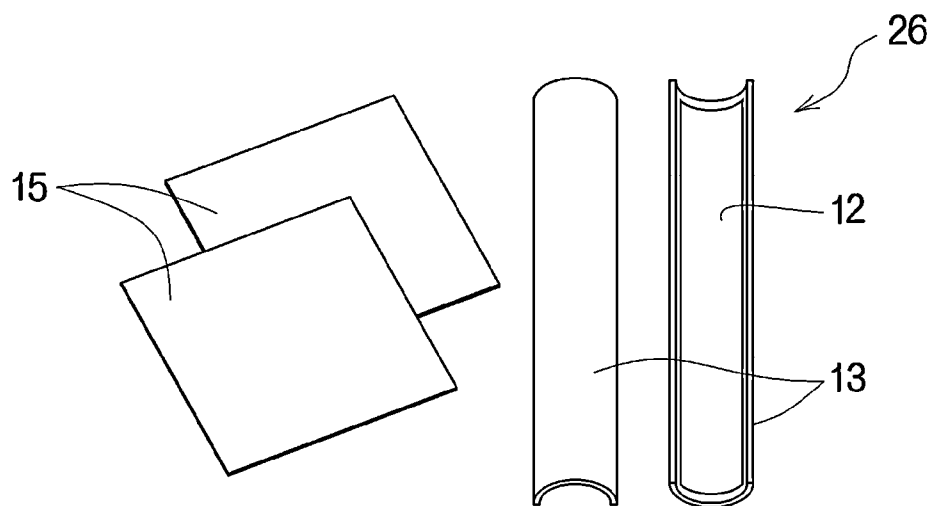


Fig. 13

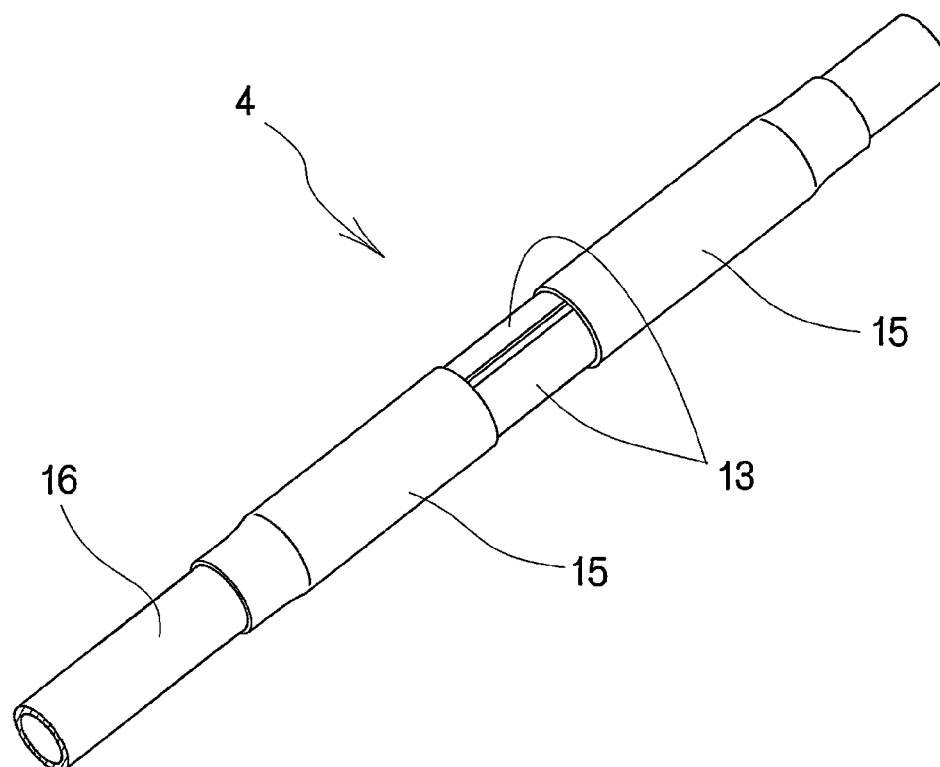


Fig. 14

Measurement Result Comparison Table 1

	Example 1	Comparative Example 1	Comparative Example 2
Stiffness (Flexural degree) (mm)	10	4	20
Impact resistance			
Fracture condition	A	C	A
Absorbed energy (J)	19	8.1	19
Safety	A	C	A
On-site repairability	A	C	A

Fig. 15

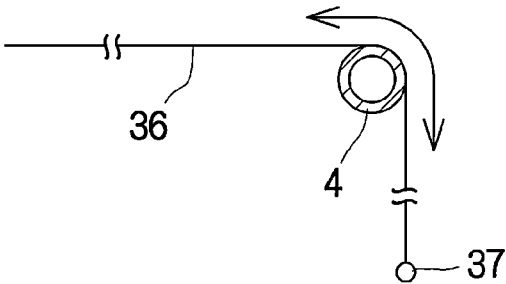
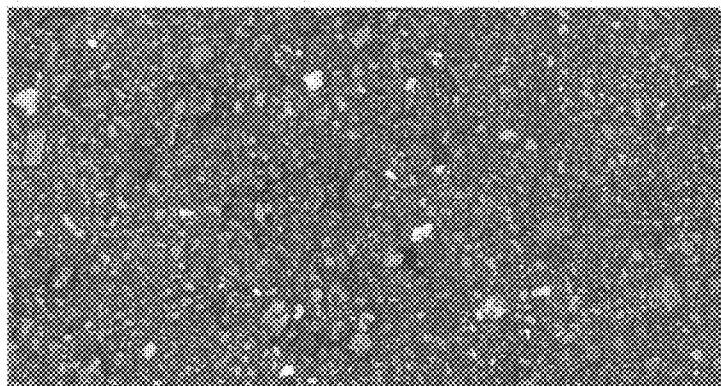
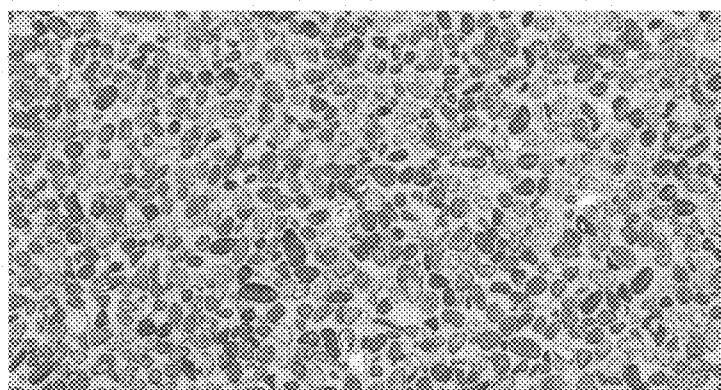


Fig. 16

(a)



(b)



(c)

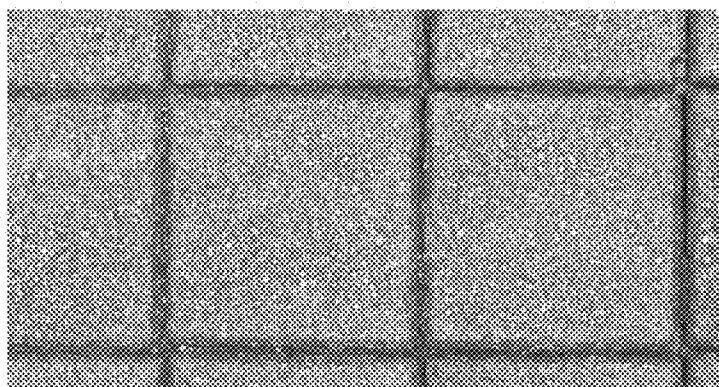


Fig. 17

Measurement Result Comparison Table 2

	Example 2	Comparative Example 3	Comparative Example 4	Comparative Example 5
Type of ferrule	Teardrop	Standard	Teardrop	Palm tip
Information transmission performance	Very good	Poor	Poor	Poor
Manipulability	Very good	Good	Poor	Good
Antisticking property	Good	Poor	Good	Poor

Fig. 18

Measurement Result Comparison Table 3

	Example 3	Comparative Example 6	Comparative Example 7
Material	Para-aramid fiber/ polyamide resin	Polypropylene resin	Polyamide resin
Mass before wear test (g)	3.46087	2.60955	3.32232
Mass after wear test (g)	3.45631	2.29837	2.88681
Wear mass (mg)	4.56	311.2	435.5
Wear condition	Constant wear	Test was discontinued after 8.7 min due to increased wear mass	Test was discontinued after 61 min due to melting

CANE AND CYLINDRICAL BODY

TECHNICAL FIELD

[0001] The present invention relates to a cane such as a white cane for the visually disabled. More particularly, the present invention relates to a cane that has a sufficient impact-resistant strength against a force in a direction perpendicular to the axis of its shaft; and is excellent in safety, durability and repairability and also lightweight but has a high stiffness.

BACKGROUND ART

[0002] A cane is also called a stick or a pole, and used not only by the visually disabled and people with limb disabilities, such as elderly people, but also by healthy people for trekking, light mountain climbing, etc. Such a cane usually has a rod-shaped shaft, a grip which is designed for the user to grasp and formed at the upper end of the shaft, and a ferrule attached to the lower end of the shaft. Conventional canes, although are more or less structurally different from each other, are made of wood, an aluminum alloy, etc. in the most cases.

[0003] For example, a so-called white cane for the visually disabled is usually used with its tip slightly lifted from the ground for a prolonged period, and thus weight saving is desired, but conventional wooden canes are heavy and give a heavy burden to the users. Furthermore, such wooden canes are unsatisfactory in strength, and may be repeatedly swelled and dried by environmental changes, resulting in undesired warpage of the shaft and detachment of the superficial coating thereof. Aluminum alloy canes are more lightweight than wooden canes, but still heavy for prolonged use and disadvantageously tend to dent and bend in response to impact.

[0004] Meanwhile, a cane having a shaft made of a carbon fiber-reinforced resin is recently proposed (for example, see Patent Literature 1). The cane having such a shaft is more lightweight than conventional wooden canes and aluminum alloy canes and is resistant to undesired warpage and corrosion.

[0005] However, the cane according to Patent Literature 1, although is more lightweight than conventional canes made of wood, an aluminum alloy, etc., is not lightweight enough, particularly to allow the visually disabled etc. to use for a prolonged period, and thus further weight saving is desired.

[0006] The above-mentioned cane having a shaft made of a carbon fiber-reinforced resin has, due to the high tensile strength and elastic modulus of carbon fibers, such a high flexural modulus as applied to, for example, a golf shaft. However, since carbon fibers as inorganic fibers have a low elongation and lack flexibility, the shaft disadvantageously tends to break in response to an impact in a direction transverse to the shaft (flexural impact). Considering this, the above-mentioned shaft has a sufficient mechanical strength as a golf shaft in striking, but is unsatisfactory as a cane shaft. This is because a cane using this shaft is given an impact when the user frequently hits the road surface and obstacles with the cane in order to examine their conditions, and the impact is transmitted to the shaft via the ferrule and may cause micro-cracks in the carbon fiber. Thus, when given an external force by bumps (against a person, a bicycle and other obstacles), etc., the cane may easily fracture at the site where cracks have been generated. Therefore, development of a cane having a

sufficient strength (flexural stiffness) against a force in a transverse direction, namely a direction perpendicular to the axis of its shaft is desired.

[0007] Further, the above-mentioned cane having a shaft made of a carbon fiber-reinforced resin may fracture in response to impact etc., be heavily damaged on the fracture surface, and have spiky ends of stiff fibers projected from the fracture surface. In this case, for example, when the visually disabled check the fracture site and the damage level, naturally by touch, the fibers exposed on the fracture surface may get stuck in the hand. Therefore, the above-mentioned cane needs to be thicker-walled so as not to easily fracture at the time of impact etc., but in this case, the weight of the cane is increased. Further, the repairability of the above-mentioned cane is unsatisfactory because the fracture site is damaged so heavily that simple repair on site is difficult. Thus, development of a cane that can be easily repaired on site has been desired.

[0008] The above-mentioned disadvantages can be overcome, for example, by forming a shaft using a high-strength organic fiber-reinforced resin composed of a para-aramid fiber, an epoxy resin and the like. However, such a shaft is excellent in impact resistance but has a lower stiffness compared with the shaft formed of a carbon fiber-reinforced resin. This stiffness of the shaft can be enhanced by thickening the layer of the high-strength organic fiber-reinforced resin, but in this case, the shaft is thicker, the amount of the resin used is increased and the weight of the cane is excessively increased.

CITATION LIST

Patent Literature

[0009] Patent Literature 1: JP-A 2005-218473

SUMMARY OF INVENTION

Technical Problem

[0010] A technical problem to be solved by the present invention is to provide a cane that is free from the above-mentioned disadvantages; has a sufficient impact-resistant strength against a force in a direction perpendicular to the axis of its shaft; and is excellent in safety, durability and repairability and also lightweight but has a high stiffness.

Solution to Problem

[0011] As a solution to the above-mentioned problem, the present invention has, for example, the following constitutions, which will be described based on FIGS. 1 to 18 showing embodiments of the present invention.

[0012] That is to say, the present invention relates to a cane having a shaft (4) and a grip (1) provided at the upper end of the shaft (4), the shaft (4) comprising a high-strength-organic-fiber-reinforced-resin layer (31) and a carbon-fiber-reinforced-resin layer (32), the high-strength-organic-fiber-reinforced-resin layer (31) being integrally laminated onto at least the outside surface of the carbon-fiber-reinforced-resin layer (32).

[0013] The present invention 2 is a cylindrical body, comprising a cylindrical high-strength-organic-fiber-reinforced-resin layer (31) and a cylindrical carbon-fiber-reinforced-resin layer (32), the high-strength-organic-fiber-reinforced-

resin layer (31) being integrally laminated onto at least the outside surface of the carbon-fiber-reinforced-resin layer (32).

[0014] The organic fiber which constitutes the high-strength-organic-fiber-reinforced-resin layer is lightweight but has a high tensile strength. Also, since organic fibers have a higher elongation compared with inorganic fibers such as carbon fibers, for example, even when the user hits the ground etc. with the tip of the cane, there is no possibility of impact-triggered microcrack generation in the organic fiber. Further, when the shaft or the cylindrical body is given an impact in a direction perpendicular to the axial direction (flexural impact), the high-strength-organic-fiber-reinforced-resin layer buckles and deforms without fracturing, and buffers this impact.

[0015] The carbon-fiber-reinforced-resin layer in each of the shaft and the cylindrical body has a high stiffness since carbon fibers have a higher elastic modulus than that of organic fibers, and thus the high-strength-organic-fiber-reinforced-resin layer does not have to be excessively thick.

[0016] Carbon fibers themselves easily break in response to flexural impact, but since the carbon-fiber-reinforced-resin layer has a high-strength-organic-fiber-reinforced-resin layer integrally laminated onto the outside surface and is protected thereby, even if carbon fibers break in response to an impact in a direction perpendicular to the axis of the shaft or the cylindrical body, the shaft or the cylindrical body only buckles and deforms without heavily fracturing, and broken spiky carbon fibers are prevented from projecting from the fracture site. In addition, a cane buckled and deformed in the shaft etc. can be easily repaired by use of, for example, a commercial repair kit etc.

[0017] The high-strength-organic-fiber-reinforced-resin layer is integrally laminated onto at least the outside surface of the carbon-fiber-reinforced-resin layer, and may be integrally laminated onto each of the outside and inside surfaces. The latter case is preferable since the carbon-fiber-reinforced-resin layer is sandwiched in between the inner and outer high-strength-organic-fiber-reinforced-resin layers and protected thereby much more favorably, and thus fracture of the shaft or the cylindrical body is prevented.

[0018] The high-strength organic fiber is not limited to specific kinds as long as it has a high mechanical strength (for example, tensile strength), etc. Examples thereof include ultra-high-molecular-weight-polyethylene fibers, wholly-aromatic polyamide fibers, wholly-aromatic polyester fibers, heterocyclic high-performance fibers and polyacetal fibers. These fibers can be used alone or as a mixture formed of two or more kinds at any ratio. Specifically, para-aramid fibers are preferably used and poly(p-phenylene terephthalamide) fibers are particularly preferable.

[0019] The shaft and the cylindrical body each comprise at least one carbon-fiber-reinforced-resin layer and at least one high-strength-organic-fiber-reinforced-resin layer, and one or both of the carbon-fiber-reinforced-resin layer and the high-strength-organic-fiber-reinforced-resin layer may be plural. It is also possible that the shaft and the cylindrical body each consist of these layers. However, it is preferable that the shaft comprises a cylindrical glass-fiber-reinforced-resin layer on the inner side of the innermost high-strength-organic-fiber-reinforced-resin layer. One reason for this is that such a constitution can provide a favorable wear resistance of the inner surface. Another reason is that, when the shaft or the cylindrical body is cut into pieces of a predetermined length

etc., such a constitution can prevent organic fibers from raveling on the inner surfaces of the cut ends and keep the cut ends in a favorable shape.

[0020] It is also preferable that the shaft comprises a cylindrical glass-fiber-reinforced-resin layer on the outer side of the outermost high-strength-organic-fiber-reinforced-resin layer. One reason for this is that such a constitution can provide a favorable wear resistance of the outer surface. Another reason is that, when the shaft or the cylindrical body is cut into pieces of a predetermined length etc., such a constitution can prevent organic fibers from raveling on the outer surfaces of the cut ends and keep the cut ends in a favorable shape.

[0021] For function as an external indicator to help, for example, the visually disabled to recognize the location and the function of the cane, or for decoration etc., the shaft preferably comprises an indicating layer on the outer side of the outermost high-strength-organic-fiber-reinforced-resin layer. The indicating layer may be a coating film of any color, pattern or the like, but is preferably a reflective tape, a red-colored tape, etc. because such tapes enable easy formation of the indicating layer in a predetermined color etc., easy repair thereof and the like.

[0022] The indicating layer on the outer surface of the shaft may be externally exposed, but it is preferable that a cylindrical glass-fiber-reinforced-resin layer or a wear-resistant transparent resin layer is provided on the outer side of the indicating layer. This is because that the indicating layer protected by such a glass-fiber-reinforced-resin layer or wear-resistant transparent resin layer has an increased wear resistance and water resistance and can also be prevented from changing in color and getting detached from the shaft.

[0023] The cross-sectional shape of the shaft is not limited to specific kinds and may be an odd shape, but is preferably a circular shape. Examples of the odd shape include an oval shape, a hollow shape, an X shape, a Y shape, a T shape, an L shape, a star shape, a leaf shape (for example, a 3-leaf shape, a 4-leaf shape, a 5-leaf shape, etc.) and other multangular shapes (for example, a triangular shape, a square shape, a pentagonal shape, a hexagonal shape, etc.).

[0024] The shaft may be solid unless the effects of the present invention are hindered, but in terms of weight saving of the cane, it is preferable that the shaft is a hollow structure composed of a hollow and a shell surrounding the hollow. In the cross-section perpendicular to the axis of the shaft, the cross-sectional area ratio of the hollow and the shell is not limited to specific values unless the ratio hinders the effects of the present invention. In order that the shaft may have a sufficient strength against a force perpendicular to the axial direction and be so lightweight as to allow prolonged use, the cross-sectional area ratio is preferably 85:15 to 56:44, and further considering excellent safety and reparability, the cross-sectional area ratio is more preferably 80:20 to 60:40, and particularly preferably 75:25 to 62:38. When the cross-sectional area ratio of the hollow to the whole of the shaft is less than 56%, the cane is not sufficiently lightweight and has such a hard shaft to tend to make the user exhausted in prolonged use, and therefore this case is not preferable. Conversely, when the cross-sectional area ratio of the hollow to the whole of the shaft exceeds 85%, the cane is too lightweight and does not have a sufficient strength against a force perpendicular to the axial direction, and therefore this case is not preferable, either.

[0025] The cane may be a non-foldable, so-called, straight cane having a shaft formed of one cylindrical body etc. Such a shaft without junctions etc. is lightweight and thus is preferable. Alternatively, the cane of the present invention may be a so-called folding cane having a shaft composed of a plurality of shaft parts. Such a cane, while not in use, can be folded up into a size compact enough to easily carry and thus is also preferable.

[0026] In the case of the above-mentioned folding cane, the shaft is composed of a plurality of mutually connectable and separable shaft parts, and in the shaft parts adjacent to each other, a first connecting end of one shaft part is provided with a smaller-diameter part that can be inserted into and removed from a second connecting end of the opposite shaft part. In this case, the number of shaft parts, i.e., the number of folds is not limited to specific numbers, and depending on the cane length and the folded dimensions, may be any appropriate number, for example, 5 to 7. The smaller-diameter part may be produced separately from the shaft part and attached thereto with an adhesive, or be formed integrally with the connecting end of the shaft part. The adhesive may be a known adhesive and is not particularly limited.

[0027] The material of the smaller-diameter part is not limited to specific kinds, but it is preferable that the smaller-diameter part is formed of a high-strength-organic-fiber-reinforced-resin layer as used for the shaft because this high-strength-organic-fiber-reinforced-resin layer can favorably reinforce the junction(s) of shaft parts and effectively prevent fracture at the junction(s), which is susceptible to stress. It is more preferable that the smaller-diameter part is formed of only a high-strength-organic-fiber-reinforced-resin layer composed of a para-aramid fiber and the like.

[0028] Preferably, the folding cane comprises a cylindrical joint cover to cover the first connecting end and the second connecting end which are connected to each other, one end of the joint cover being fitted onto one of the first and second connecting ends and fixed thereto, the other end of the joint cover being configured such that the other connecting end can be inserted thereinto and removed therefrom. This is advantageous because such a joint cover can tightly hold the ends of these shaft parts connected to each other and does not allow any backlash.

[0029] The shape of the grip is not particularly limited unless the shape hinders the effects of the present invention, and examples thereof include an I shape and a T shape. The grip may be composed of only resin, or formed by coating the outside of any core with resin. The grip is preferably hollow structured in terms of weight saving, and in this case, a hollow structured core may be used.

[0030] The resin used for the grip is not particularly limited unless the resin hinders the effects of the present invention. Examples thereof include polyester resins, polyamide resins (for example, nylons such as nylon 6, 66 nylon and MC nylon), acrylate resins, ABS resins, polyolefin resins (for example, polypropylene resins, polyethylene resins, etc.), polybutylene terephthalate resins and polyethylene terephthalate resins. Fiber-reinforced resins may be also used. Examples of the material used for the core include silicone and nylon. In particular, it is preferable that the grip is formed of, for example, the same materials as those of the shaft, namely a carbon fiber-reinforced resin and a high-strength organic fiber-reinforced resin, because such a grip is lightweight, highly strong and producible at low cost.

[0031] The dimensions such as the length and diameter of the grip are appropriately determined if needed. The production method of the grip is not particularly limited and known methods can be used. Commercial products may be also used.

[0032] Preferably, the grip has a hollow-structured grip body extended from the upper end of the shaft, the cross-section perpendicular to the axis of the grip body being larger than that of the shaft. This is advantageous because such a grip is lightweight but thick enough for the user to firmly grasp. The outer surface of the grip body may be externally exposed as it is, or be in an antislip shape such as uneven patterns. However, it is preferable that the grip has an antislip member on at least part of the outer surface of the grip body etc., the antislip member being a coating layer formed of rubber, a synthetic resin, etc. or being a commercial grip tape or the like. This is advantageous because the user can securely grasp such a grip.

[0033] A ferrule may be provided at the lower end of the shaft. The shape and material of the ferrule are not limited to specific kinds, but it is preferable that the ferrule is formed of a high-strength organic fiber-reinforced resin in which staple fibers of a high-strength organic fiber are dispersed in a synthetic resin, because such a ferrule is excellent in usage characteristics and wear resistance.

[0034] That is to say, in the case of a cane having a ferrule formed of such a high-strength organic fiber-reinforced resin, when the user, while walking, lightly hits and traces the road surface with the tip of the cane in order to examine the conditions thereof, the ferrule favorably reacts against the objects. For example, when the ferrule touches the road surface, the ferrule lightly bounces back therefrom and transmits information such as the degree of bouncing-back movement, a sound generated when the ferrule hits the road surface, and a feel given when the ferrule moves along the road surface, and such information clearly varies with the kind and material of the road surface such as an asphalt pavement and a concrete pavement. Such a movement and the like are considered to be influenced collectively by various characteristics of the ferrule, such as hardness, density, elastic coefficient, frictional resistance and wear resistance, based on the material of the ferrule.

[0035] Accordingly, a cane having such a ferrule is advantageous because the cane can clearly transmit information to the user, regarding not only obstacles and unevenness on the road surface but also detailed unevenness, feels of materials, etc., so as to enable more accurate recognition of the kind of the road surface toward the walking direction etc., and therefore the visually disabled can walk more safely with a sense of great security. More advantageously, since the ferrule favorably reacts against objects to be examined, the necessity of excessively swinging around the cane or poking about therewith is reduced and the burden to the user's hand and wrist is reducible. More advantageously, the sound generated when the cane hits objects to be examined is not so loud, and thus the manipulability is excellent. From the above, it is understood that the cane is excellent in usage characteristics and particularly preferable as a white cane for the visually disabled because the cane favorably works as a sensor, and that the cane is also lightweight and excellent in durability.

[0036] The high-strength organic fiber content of the high-strength organic fiber-reinforced resin is not limited to specific amounts. However, when the content is too small, usage characteristics and wear-resistant effect are not sufficiently obtained, and when the content is excessively high, the fibers

cannot be easily dispersed in the synthetic resin. Therefore, the content ratio of the high-strength organic fiber is preferably 10 to 60 mass %, and more preferably 20 to 50 mass %.

[0037] The high-strength organic fiber is not limited to specific kinds as long as it has a high mechanical strength (for example, tensile strength), etc. Examples thereof include ultra-high-molecular-weight-polyethylene fibers, wholly-aromatic polyamide fibers, wholly-aromatic polyester fibers, heterocyclic high-performance fibers and polyacetal fibers. These fibers can be used alone or as a mixture formed of two or more kinds at any ratio. Specifically, para-aramid fibers are preferably used, and because of the properties of being easily fibrillated and dispersible, poly(p-phenylene terephthalamide) fibers are particularly preferable.

[0038] The high-strength organic fiber is dispersed as a staple fiber in the synthetic resin. The thickness and length of the staple fiber are not limited to specific values as long as the staple fiber can be dispersed in the synthetic resin. Inter alia, a high-strength organic fiber with a filament fineness of about 1.1 to 2.3 dtex and with a fiber length of about 2 to 8 mm can favorably disperse and thus is preferable. Further, such a high-strength organic fiber can sufficiently deliver usage characteristics, wear resistance, etc. required for ferrules.

[0039] The synthetic resin is not limited to specific kinds as long as it can disperse high-strength organic fibers and be formed into a ferrule, but is preferably a thermoplastic synthetic resin in terms of easy shaping. Specific examples thereof include polyester resins, polyamide resins (for example, nylons such as 6 nylon, 66 nylon and MC nylon), acrylate resins, ABS resins, polyolefin resins (for example, polypropylene resins, polyethylene resins, etc.), polybutylene terephthalate resins and polyethylene terephthalate resins. Polyamide resins are particularly preferable because of their excellent wear resistance.

Advantageous Effects of Invention

[0040] The present invention, which has constitutions and functions as described above, exhibits the following effects.

(1) Since the carbon-fiber-reinforced-resin layer has a high stiffness, even when given a force in the axial direction, the shaft does not curve or bend, and thus the user can use the cane with a sense of security.

(2) Since the high-strength-organic-fiber-reinforced-resin layer is excellent in vibration damping, vibration etc. of the tip of the cane can be accurately transmitted to the user's hand.

(3) Since a lightweight high-strength-organic-fiber-reinforced-resin layer and a highly stiff carbon-fiber-reinforced-resin layer are comprised in combination, the shaft and the cylindrical body each have a high strength and are lightweight without the need of an excessively thick high-strength-organic-fiber-reinforced-resin layer.

(4) Since the high-strength-organic-fiber-reinforced-resin layer is comprised, even when the user hits the ground, obstacles, etc. with the tip of the cane, there is no possibility of impact-triggered microcrack generation in the high-strength organic fiber, and thus the durability is excellent.

(5) Even when a great flexural impact is applied in a direction perpendicular to the axial direction, the high-strength-organic-fiber-reinforced-resin layer can buffer the impact by buckling deformation, deliver an excellent performance in mechanical strength such as impact resistance, and thus favorably prevent the shaft from fracturing.

(6) Even if carbon fibers break in response to a great flexural impact in a direction perpendicular to the axial direction, the carbon-fiber-reinforced-resin layer is protected by the high-strength-organic-fiber-reinforced-resin layer integrally laminated onto the outside surface thereof, and thus heavily fracturing is prevented. Broken spiky carbon fibers are also prevented from projecting from the site to which the flexural impact has been given. Accordingly, for example, the visually disabled etc. can safely check such a damaged site by touch or the like.

(7) Since each of the shaft and the cylindrical body does not easily fracture even when given a great flexural impact in a direction perpendicular to the axial direction, they can be easily repaired by use of, for example, a commercial repair kit etc., for example, at the venue where the impact has been given, and the repaired cane etc. can be continuously used.

BRIEF DESCRIPTION OF DRAWINGS

[0041] FIG. 1 shows a first embodiment of the present invention, FIG. 1 (a) is an outline view of a straight cane, and FIG. 1 (b) is an A-A arrowed cross-sectional view of FIG. 1 (a). An outline view of a straight cane is shown.

[0042] FIG. 2 is a partially cutaway view showing the laminated structure of the shaft according to the first embodiment.

[0043] FIG. 3 is a partially cutaway view of the grip of the cane according to the first embodiment.

[0044] FIG. 4 is a partial cutaway and perspective view showing the vicinity of the ferrule of the cane according to the first embodiment.

[0045] FIG. 5 is a partially cutaway view showing the laminated structure of the shaft according to a second embodiment of the present invention.

[0046] FIG. 6 shows a third embodiment of the present invention, FIG. 6 (a) is an outline view of a folding cane, and FIG. 6 (b) is an enlarged sectional view of part B in FIG. 6 (a).

[0047] FIG. 7 is an outline view of the cane in a folded state according to the third embodiment.

[0048] FIG. 8 is a sectional view of the vicinity of the joint cover of the cane in an unconnected state according to the third embodiment.

[0049] FIG. 9 is a sectional view of the vicinity of the joint cover of the cane in a connected state according to the third embodiment.

[0050] FIG. 10 is an outline view of the grip according to modified example 1 of the present invention.

[0051] FIG. 11 is a segmentary view of the vicinity of the ferrule according to modified example 2 of the present invention.

[0052] FIG. 12 is a perspective view showing the emergency repair kit used for the reparability test.

[0053] FIG. 13 is a perspective view showing the state of the main part of the cylindrical body in the reparability test.

[0054] FIG. 14 is comparison table 1 showing the measurement results of each characteristic value of the shaft of the present invention in comparison with Comparative Examples.

[0055] FIG. 15 is a schematic view of the measuring device used for measurement of the wear resistance of the outer surface of the shaft.

[0056] FIG. 16 shows the road surfaces used for examination of the usage characteristics of the ferrule, FIG. 16 (a) is an image of an asphalt pavement, FIG. 16 (b) is an image of

a concrete pavement arranged with gravels on the surface, and FIG. 16 (c) is an image of a concrete pavement with a tiled pattern.

[0057] FIG. 17 is comparison table 2 showing the measurement results on the usage characteristics of the ferrule of the present invention in comparison with Comparative Examples.

[0058] FIG. 18 is comparison table 3 showing the measurement results on the wear property of the ferrule of the present invention in comparison with Comparative Examples.

DESCRIPTION OF EMBODIMENTS

[0059] Hereinafter, the present invention will be described in detail based on the drawings.

[0060] As shown in FIG. 1 (a), a cane (7) of a first embodiment has a shaft (4), a grip (1) provided at the upper end of the shaft (4), and a ferrule (6) fixedly attached to the lower end of the shaft (4).

[0061] As shown in FIG. 1 (b), the shaft (4) is in the shape of a hollow cylinder of which the cross-section perpendicular to the axis is in a circular shape. As shown in FIG. 2, the shaft (4) comprises a cylindrical high-strength-organic-fiber-reinforced-resin layer (31), a cylindrical carbon-fiber-reinforced-resin layer (32), and a cylindrical glass-fiber-reinforced-resin layer (33).

[0062] That is to say, a first high-strength-organic-fiber-reinforced-resin layer (31a) is integrally laminated onto the inside surface of the carbon-fiber-reinforced-resin layer (32), and a cylindrical first glass-fiber-reinforced-resin layer (33a) is integrally laminated onto the inside surface of the first high-strength-organic-fiber-reinforced-resin layer (31a). Further, a second high-strength-organic-fiber-reinforced-resin layer (31b) is integrally laminated onto the outside surface of the carbon-fiber-reinforced-resin layer (32), and a cylindrical second glass-fiber-reinforced-resin layer (33b) is integrally laminated onto the outside surface of the second high-strength-organic-fiber-reinforced-resin layer (31b).

[0063] As shown in FIGS. 1 and 2, to the outside surface of the second glass-fiber-reinforced-resin layer (33b), which is laminated onto the outside surface of the second high-strength-organic-fiber-reinforced-resin layer (31b), a white reflective tape (15) and a red-colored tape (16) are attached as an indicating layer (34). The outside surface of the indicating layer (34) is covered with a wear-resistant transparent resin layer (35). As long as the wear-resistant transparent resin layer (35) is so excellent in wear resistance, water resistance, etc. as to effectively protect the indicating layer (34), the material thereof is not limited to specific kinds. Specifically, ionomer resin films, such as HIMILAN (trade name, manufactured by DU PONT-MITSUI POLYCHEMICALS), and others are used as a monolayer or a multilayer.

[0064] In the cross-section perpendicular to the axis of the shaft (4), the cross-sectional area ratio of a hollow (17) and a shell (18) surrounding the hollow is not limited to specific values. In order that the shaft may have a sufficient strength and stiffness against a force perpendicular to the axial direction and be so lightweight as to allow prolonged use, the cross-sectional area ratio is appropriately selected from the ranges of usually 85:15 to 56:44, preferably 80:20 to 60:40, and more preferably 75:25 to 62:38.

[0065] To prevent the shaft (4) from easily fracturing even when the shaft (4) is given an impact perpendicular to the axial direction, for example when a bicycle bumps against the user of the cane (7), the impact resistance against a force

perpendicular to the axial direction is preferably such a degree that an impact energy of 10J or larger is absorbable. In terms of increased safety and repairability, 15J or larger is more preferable. The impact resistance can be measured using the Drop Weight Impact Tester manufactured by Instron (product name: Drop Weight Impact Tester, Dynatup (registered trademark) 9200 series), etc., according to the three point flexural test specified in JIS K 7055:1995 (Testing method for flexural properties of glass fiber-reinforced plastics).

[0066] The shaft (4) may be a tapered cylindrical body in which the outer diameter changes in the direction from one end toward the other end, but it is preferable that the shaft (4) is a cylindrical body in which the outer diameter is at constant length from one end to the other end, because such a shaft (4) can be easily produced by forming a cylinder of any length and cutting into pieces of a predetermined dimension.

[0067] The high-strength-organic-fiber-reinforced-resin layer (31) which constitutes the shaft (4) can be produced by a known method, that is, for example, by impregnating high-strength organic fibers, such as para-aramid fibers, with resin such as an epoxy resin, shaping the mixture into a predetermined cylinder, heating the cylinder, for example, at a temperature of room temperature to about 130° C. for curing of the resin, and cutting the cured product into pieces of a predetermined length. The carbon-fiber-reinforced-resin layer (32) and the glass-fiber-reinforced-resin layer (33) can be similarly produced.

[0068] The organic fiber which constitutes the high-strength-organic-fiber-reinforced-resin layer (31) is not limited to specific kinds. For example, any of ultra-high-molecular-weight-polyethylene fibers, wholly-aromatic polyamide fibers, wholly-aromatic polyester fibers, heterocyclic high-performance fibers, polyacetal fibers and the like can be used alone or in a combination of two or more kinds.

[0069] Examples of the carbon fiber which constitutes the carbon-fiber-reinforced-resin layer (32) include polyacrylonitrile-based carbon fibers and pitch-based carbon fibers. Examples of the glass fiber which constitutes the glass-fiber-reinforced-resin layer (33) include alkali glass fibers, alkali-free glass fibers and low-dielectric glass fibers. However, the organic, carbon and glass fibers used for the present invention are not limited to the foregoing examples.

[0070] The ultra-high-molecular-weight-polyethylene fiber means a fiber composed of ultra-high-molecular-weight-polyethylene resin. Here, a suitable ultra-high-molecular-weight-polyethylene resin has a molecular weight of about 200,000 or more, preferably about 600,000 or more, and examples thereof include, besides homopolymers, copolymers with lower α -olefins having about 3 to 10 carbon atoms such as propylene, butene, pentene and hexene. In the case of a copolymer of ethylene with an α -olefin, it is suitable that the ratio of the latter per 1000 carbon atoms is about 0.1 to 20 molecules, preferably about 0.5 to 10 molecules on average. The method for producing ultra-high-molecular-weight-polyethylene fibers is disclosed by, for example, JP-A 55-5228 and JP-A 55-107506, and such disclosed methods known per se may be used. Commercial products, such as Dyneema (trade name, manufactured by Toyobo Co., Ltd.), Spectra (trade name, manufactured by Honeywell International, Inc.), and HI-ZEX MILLION (trade name, manufactured by Mitsui Chemicals, Inc.) may be also used as the ultra-high-molecular-weight-polyethylene fiber.

[0071] The wholly-aromatic polyamide fiber is not particularly limited and examples thereof include aramid fibers. As the aramid fiber, para-aramid fibers are preferred. Examples of the para-aramid fiber include poly(para-phenylene terephthalamide) fibers (manufactured by DU PONT-TORAY CO., LTD., trade name: KEVLAR 29, 49, 149, etc.) and copoly(p-phenylene-3,4'-diphenyl ether terephthalamide) fibers (manufactured by TEIJIN LIMITED, trade name: Technora). Inter alia, poly(p-phenylene terephthalamide) fibers are particularly preferred. The wholly-aromatic polyamide fiber can be produced by a known method or its modified method. Alternatively, the commercial products as mentioned above may be also used.

[0072] The wholly-aromatic polyester fiber is not particularly limited and examples thereof include fibers composed of, for example, a self-condensed polyester made of p-hydroxybenzoic acid, a polyester made of terephthalic acid and hydroquinone, or a polyester made of p-hydroxybenzoic acid and 6-hydroxy-2-naphthoic acid. The wholly-aromatic polyester fiber can be produced by a known method or its modified method. Alternatively, commercial products such as Vectran (trade name, manufactured by Kuraray Co., Ltd.) can be also used.

[0073] The heterocyclic high-performance fiber is not particularly limited and examples thereof include poly(p-phenylene benzobisthiazole) (PBZT) fibers and poly(p-phenylene benzobisoxazole) (PBO) fibers. The heterocyclic high-performance fiber can be produced by a known method or its modified method. Alternatively, PBO fibers such as Zylon (trade name, manufactured by Toyobo Co., Ltd.) and the like can be also used.

[0074] The polyacetal fiber is not particularly limited and can be produced by a known method or its modified method. Alternatively, commercial products such as Tenac (trade name, manufactured by Asahi Kasei Corporation) and Dirline (trade name, manufactured by Du Pont) can be also used.

[0075] The resin with which the above-mentioned high-strength organic fibers, carbon fibers or glass fibers are impregnated is not particularly limited unless the resin hinders the effects of the present invention. Examples thereof include thermosetting resins such as epoxy resins, unsaturated polyester resins and vinyl ester resins. Thermoplastic resins are also included. These resins can be used alone or as a mixture formed of two or more kinds at any ratio.

[0076] Examples of the epoxy resin include diglycidyl ether compounds of bisphenol A, bisphenol AD, bisphenol F or bisphenol S, or their high-molecular-weight homologs, poly(glycidyl ether) of phenol novolac, and poly(glycidyl ether) of cresol novolac. In addition, halogenated derivatives of the foregoing examples can be also used. Further, aromatic epoxy resins etc. obtainable by reaction of a phenol, such as bisphenol A, bisphenol AD, bisphenol F and bisphenol S, with a glycidyl ether thereof may be used, and aliphatic epoxy resins may be used as well. The epoxy resin is not particularly limited unless it hinders the effects of the present invention. The epoxy resin can be obtained according to a known production method, and commercial products thereof may be also used.

[0077] The unsaturated polyester resin is not particularly limited unless it hinders the effects of the present invention. The unsaturated polyester resin can be produced by a known method, and commercial products thereof may be also used. For example, the unsaturated polyester resin can be obtained from an alcohol component (polyhydric alcohol), an α , β -un-

saturated polyvalent carboxylic acid, and an acid component (saturated polyvalent carboxylic acid and aromatic polyvalent carboxylic acid) according to a known production method. The vinyl ester resin is not particularly limited unless it hinders the effects of the present invention. The vinyl ester resin can be produced by a known method, and commercial products thereof may be also used.

[0078] The thermoplastic resin is not particularly limited unless it hinders the effects of the present invention. Any of thermoplastic styrene resins, thermoplastic polyolefin resins, thermoplastic polyvinyl chloride resins, thermoplastic polyurethane resins, thermoplastic polyester resins, thermoplastic polyimide resins and other thermoplastic resins may be used, but thermoplastic polyolefin resins are preferred. The thermoplastic polyolefin resin is not particularly limited and examples thereof include thermoplastic polypropylene resins, thermoplastic polystyrene resins and thermoplastic acrylonitrile-butadiene-styrene resins (ABS resin). In addition, synthetic resins, such as ethylene-propylene rubber (EPDM), synthetic rubber based on a styrene-butadiene copolymer (SBR), and nitrile rubber (NBR), can be also used.

[0079] The content ratio of the fiber and the resin in each of the above-mentioned layers is not particularly limited to specific values unless the content ratio hinders the effects of the present invention. The content ratio varies with the kinds of the organic fiber and the resin, and the dimension of the shaped product. In order that the shaft may have a desired strength, for example, a sufficient flexural stiffness, and be so lightweight as to allow prolonged use, resistant to fracture and excellent in safety and reparability, the content ratio as a mass ratio is selected from the ranges of 80:20 to 60:40, preferably 75:25 to 65:35, and more preferably 70:30 to 67:33. When the amount of the impregnating resin is too large, an appropriate strength cannot be easily maintained. When the amount of the impregnating resin is too small, shaped products cannot be obtained or, if obtained, do not have an appropriate strength. Here, the term "appropriate strength" means a strength for achieving the effects of the present invention.

[0080] The specific gravity of the shaft (4) varies with the kinds of the high-strength organic fiber and the resin to be used, the content ratio thereof and the like, but is preferably about 1.30 to 1.45, more preferably 1.32 to 1.37, and particularly preferably 1.33 to 1.36.

[0081] The weight and strength of the cane (7) vary with the thickness of the cane (7), the thickness of the shell (18), the fiber-resin content ratio in each of the fiber-reinforced resin layers (31, 32, 33), the thickness of each of the layers, the kind of the resin, etc. Since high-strength organic fibers have a smaller specific gravity than that of carbon fibers, by using less of the carbon-fiber-reinforced-resin layer (32) and more of the high-strength-organic-fiber-resin layer (31), a lightweight and strong cane (7) is obtainable. In this case, the specific gravity of the shaft (4) is not limited to specific values, but is preferably 1.30 to 1.45. In order that the shaft (4) may have a sufficient flexural stiffness against a force perpendicular to the axial direction and be so lightweight as to allow prolonged use, the specific gravity is more preferably 1.32 to 1.37, and particularly preferably 1.33 to 1.36.

[0082] In the first embodiment, the grip (1) is in an I shape, and if needed, a connector (2), a strap (3), etc. may be attached to any site of the grip (1). Alternatively, in the present invention, the grip (1) may be in other shapes such as a T shape as

mentioned below. The length and thickness of the grip (1) are appropriately determined as such dimensions that the user can firmly grasp the grip (1).

[0083] As shown in FIG. 3, the grip (1) has a hollow-structured grip body (19) extended upward from the upper end of the shaft (4). The grip body (19) maybe formed integrally with the shaft (4) by expanding one end of the shaft (4) into a predetermined shape by, for example, blow molding, vacuum molding, etc. In this case, since the cross-section perpendicular to the axis of the grip body (19) is larger than that of the shaft (4), the grip (1) is easy for the user to firmly grasp. In addition, since the grip (1) is hollow-structured, weight saving of the grip (1) can be easily achieved. Further, since the same fiber-reinforced resin materials as those of the shaft (4) are used, a strong grip (1) can be produced at low cost.

[0084] Alternatively, in the present invention, the grip (1) may be separately formed and fixed to the upper end of the shaft (4) with an adhesive etc. Further, the grip (1) may be also formed by coating the outside of any core with resin. In this case, the core may be hollow structured. These grips (1) can be commercial products, or produced by a known method. The production method is not particularly limited and the dimensions such as the length and diameter of the grip are appropriately determined if needed.

[0085] The resin used for the grip (1) is not particularly limited unless it hinders the effects of the present invention. Examples thereof include polyester resins, polyamide resins (for example, nylons such as nylon 6, 66 nylon and MC nylon), acrylate resins, ABS resins, polyolefin resins (for example, polypropylene resins, polyethylene resins, etc.), polybutylene terephthalate resins and polyethylene terephthalate resins. Fiber-reinforced resins may be also used. Examples of the material used for the core include silicone and nylon. In particular, it is preferable that the grip (1) is formed of, for example, a carbon fiber-reinforced resin and a high-strength organic fiber-reinforced resin, because such a grip (1) is lightweight, highly strong and producible at low cost.

[0086] The outer surface of the grip body (19) may be externally exposed as it is, but preferably the outer surface of the grip body (19) is in an antislip shape such as uneven patterns, or has an antislip member (20) attached thereto as shown in FIG. 3 because such a grip (1) is easy for the user to hold. The antislip member (20) may be a coating made of synthetic resins such as urethane, rubber materials, etc. Alternatively, as the antislip member (20), a tape made of such materials may be attached around the gripper. Particularly, the latter case is preferable because such an antislip member (20), after damaged as a result of wear etc., can be easily replaced by a new antislip member (20).

[0087] As shown in FIGS. 1 and 4, the ferrule (6) is fixed to the lower end of the shaft (4). The ferrule (6) is formed of a high-strength organic fiber-reinforced resin and in a so-called teardrop shape, in which the upper part is truncated conical and the lower part is spherical. The ferrule (6) has a joint hole (25) as a recess in the upper end, and the lower end of the shaft (4) is fitted into the joint hole (25) and fixed thereto.

[0088] Fixation of the ferrule (6) to the shaft (4) may be performed using adhesives etc. so that the ferrule (6) and the shaft (4) are inseparable. This is preferable because the ferrule (6) does not separate from the shaft (4) during use. Alternatively, separable fixation may be performed by press

fit etc. This case is also preferable because such a ferrule (6), after worn out, can be easily replaced by a new one.

[0089] It is also preferable that the ferrule (6) is fitted onto the lower end of the shaft (4) as described above, because the lower end of this shaft (4) can be protected by the ferrule (6). Alternatively, in the present invention, for example, a joint part, which may be in the shape of rod or the like, may be protruded from the upper end of the ferrule (6), inserted into the lower end of the shaft (4) and thereby fixed thereto.

[0090] The thickness and length of the ferrule (6) can be appropriately determined within the range where the effects of the present invention are not hindered. For example, the outer diameter of the ferrule (6) is larger than that of the shaft (4) and is such a dimension to prevent the ferrule from being easily caught in the grating covers on the road surface, etc. The outer surface of the ferrule (6) is smoothly curved so that the ferrule is not stuck to steps on roads, stairs and the like, obstacles, etc.

[0091] The high-strength organic fiber-reinforced resin which constitutes the ferrule (6) is one obtained by dispersing staple fibers of a high-strength organic fiber in a synthetic resin. When the high-strength organic fiber content is too low, the ferrule (6) does not fully work as a sensor. Conversely, when the content is excessively high, the fibers cannot be easily dispersed in the synthetic resin. Therefore, the ratio of the high-strength organic fiber in the high-strength organic fiber-reinforced resin is preferably 10 to 60 mass %, and more preferably 20 to 50 mass %.

[0092] Examples of the high-strength organic fiber include ultra-high-molecular-weight-polyethylene fibers, wholly-aromatic polyamide fibers, wholly-aromatic polyester fibers, heterocyclic high-performance fibers and polyacetal fibers, as is the case with the high-strength organic fiber which constitutes the shaft (4). These fibers may be used alone or in a combination of two or more kinds. Specifically, para-aramid fibers are preferably used and poly(p-phenylene terephthalamide) fibers are particularly preferable.

[0093] The dimensions of the high-strength organic fiber dispersed in the synthetic resin vary with the kinds of the high-strength organic fiber and the synthetic resin, etc., but preferred is a high-strength organic fiber with a filament fineness of about 1.1 to 2.3 dtex and with a fiber length of about 2 to 8 mm because such a high-strength organic fiber can favorably disperse.

[0094] The synthetic resin used for dispersion of the high-strength organic fiber may be a thermosetting synthetic resin etc., but thermoplastic synthetic resins are preferable because they enable easy formation of the ferrule (6) in a predetermined shape. The thermoplastic synthetic resin is not particularly limited to specific kinds, but polyamide resins such as 6 nylon, 66 nylon and MC nylon are preferable because they enable easy dispersion of the high-strength organic fiber and easy formation of the ferrule (6) and are excellent in wear resistance etc.

[0095] The high-strength organic fiber-reinforced resin may contain any fibers such as polyamide fibers, in addition to the above-mentioned high-strength organic fiber. Further, any additives for enhancing wear resistance, durability, light resistance, etc., bulking agents, colorants, etc. may be contained.

[0096] In the first embodiment, a case where the indicating layer is covered with a wear-resistant transparent resin layer is described. However, in the present invention, for example, a cylindrical glass-fiber-reinforced-resin layer (33b) may be

laminated onto the outside surface of the indicating layer (34), according to a second embodiment shown in FIG. 5.

[0097] That is to say, according to the second embodiment, the indicating layer (34) is formed on the outside surface of a second high-strength-organic-fiber-reinforced-resin layer (31b), and a second glass-fiber-reinforced-resin layer (33b) is integrally laminated onto the outside surface of the indicating layer (34). The second glass-fiber-reinforced-resin layer (33b) is transparent, and thus the indicating layer (34) can be clearly seen from the outside. Further, the second glass-fiber-reinforced-resin layer (33b) is excellent in wear resistance and water resistance, and thus prevents the indicating layer (34) from getting worn or getting wet and detached. Unlike the first embodiment, no wear-resistant transparent resin layer is needed and thus the corresponding cost can be cut. Other constitutions are the same as those of the first embodiment and function similarly. Therefore, descriptions thereof will be omitted.

[0098] In the first embodiment, a straight cane is described. However, the cane of the present invention may be a folding cane, for example, as shown in FIGS. 6 and 7.

[0099] According to a third embodiment, as shown in FIG. 6(a), a cane (7) has a shaft (4), a grip (1) provided at the upper end of the shaft (4), and a ferrule (6) fixedly attached to the lower end of the shaft (4), as is the case with the first embodiment. However, unlike the first embodiment, the shaft (4) consists of a plurality of mutually connectable and separable shaft parts (14), for example, five shaft parts (14), and a cylindrical joint cover (5) is provided to cover each junction where two shaft parts (14) are connected to each other. The grip (1) is extended from the upper end of the top shaft part (14) and formed integrally therewith.

[0100] As is the case with the shaft (4) of the first embodiment, the shaft part (14) is in the shape of a hollow cylinder of which the cross-section perpendicular to the axis is in a circular shape. In addition, as shown in FIG. 6(b), the shaft part (14) comprises a carbon-fiber-reinforced-resin layer (32) and a high-strength-organic-fiber-reinforced-resin layer (31) integrally formed on each of the inside and outside surfaces of the carbon-fiber-reinforced-resin layer (32). Further, on each of the outer and inner high-strength-organic-fiber-reinforced-resin layers (31), a glass-fiber-reinforced-resin layer (33) is provided. On the outside surface of the second glass-fiber-reinforced-resin layer (33b), a white reflective tape (15) and a red-colored tape (16) are attached, and the outside surface of each tape is covered with a wear-resistant transparent resin layer (35).

[0101] As shown in FIGS. 8 and 9, in the shaft parts (14) adjacent to each other, an inner pipe (9) as a smaller-diameter part is fixedly secured to a first connecting end (21) of one shaft part (14), and a rubber cord (8) connecting the shaft parts (14) is inserted through the inner pipe (9). The protruding length of the inner pipe (9) protruding outward from the first connecting end (21) is not limited to specific values as long as the length is enough for firm connection of the shaft parts (14). For example, the length is about 30 to 50 mm.

[0102] The material and thickness of the rubber cord (8) are not particularly limited as long as the rubber cord (8) is so elastic and stretchy as to allow easy separation and connection of the shaft parts (14), and known rubber cords can be used.

[0103] The inner pipe (9) has an outer diameter approximately equal to the inner diameter of the shaft part (14), and can be inserted into and removed from a second connecting

end (22) of the opposite shaft part (14). According to this embodiment, the inner pipe (9) is formed separately from the shaft part (14) and one end thereof is fixed into the first connecting end (21) by press fit, known adhesives, etc. Alternatively, in the present invention, the smaller-diameter part may be formed integrally with the connecting end of the shaft part (14). The material of the inner pipe (9) is not limited to specific kinds, but the inner pipe (9) preferably comprises a high-strength-organic-fiber-reinforced-resin layer and a glass-fiber-reinforced-resin layer as used for the shaft part (14), and more preferably comprises only a high-strength-organic-fiber-reinforced-resin layer composed of a para-aramid fiber and the like. Unlike the shaft part (14), it is preferable that the inner pipe (9) does not comprise any carbon-fiber-reinforced-resin layer.

[0104] One end of the joint cover (5) is fitted onto the first connecting end (21) and fixed thereto. The joint cover (5) is not limited to specific shapes as long as it is cylindrical and can connect the shaft parts (14). However, it is preferable that the outer surface of the joint cover (5) is so smooth as not to be caught in other objects. For example, the joint cover (5) is in a cylindrical shape with the diameter slightly decreasing toward both ends, and has a ring-shaped stopper (23) inside centered on the length of the joint cover. The rubber cord (8) penetrates the stopper (23). The first connecting end (21) is inserted from one end of the joint cover (5) until it abuts against the stopper (23), and is firmly fixed by press fit, known adhesives, etc.

[0105] The other end of the joint cover (5) faces and is open for the second connecting end (22), and has an inlet (24) therein. By inserting the second connecting end (22) into the inlet (24), the shaft parts (14) are connected to each other, and by removing the second connecting end (22) from the inlet (24), the shaft parts (14) are separated from each other.

[0106] The inlet (24) has a tapered part (10) with the diameter gradually decreasing inward from the outer end, and a straight part (11) having a predetermined inner diameter and extended further inward from the inner end of the tapered part (10) to the stopper (23). The inner diameter of the straight part (11) is determined as such a dimension that the inner surface of the straight part (11) can tightly press the outer surface of the second connecting end (22) without any backlash.

[0107] The length of the joint cover (5) is not limited to specific values and can be appropriately determined within the range where the effects of the present invention are not hindered. The length of the tapered part (10) is preferably larger than that of the straight part (11). In this case, the axial alignment of the shaft parts (14) to be connected is easy and the second connecting end (22) can be smoothly guided. Specifically, the tapered part-straight part ratio is preferably about 5 to 2:1. The length of the straight part (11) is not limited to specific values as long as the length neither allows any backlash in the junction nor hinders any effect of the present invention. However, because connection and separation cannot be easily performed in the case of an excessively long straight part, the length of the straight part (11) is preferably about 20 to 80% of the outer diameter of the shaft (4) in general.

[0108] The joint cover (5) is produced from, for example, polyamides such as nylon 6. As long as the joint cover (5) can firmly hold the junction and effects of the present invention are not hindered, the material thereof is not limited to specific kinds. Specifically, for example, thermosetting resins such as epoxy resins, unsaturated polyester resins and vinyl ester

resins may be used. In addition, thermoplastic resins such as polyester resins, polyamide resins (for example, nylons such as nylon 6, 66 nylon and MC nylon), acrylate resins, ABS resins, polyolefin resins (for example, polypropylene resins, polyethylene resins, etc.), polybutylene terephthalate resins and polyethylene terephthalate resins may be used. Further, materials having rubber elasticity, such as synthetic rubbers and elastomers, may be used. The joint cover (5) can be produced by a known method. In the production, known additives, pigments, etc. may be appropriately added if needed, and fiber-reinforced resins may be used. Also, coloring etc. may be performed after the production.

[0109] After the second connecting end (22) is inserted into the inlet (24) of the joint cover (5), the second connecting end (22) is smoothly guided by the tapered part (10), passes along the straight part (11) and then abuts against the stopper (23). In this way, connection as shown in FIG. 9 is achieved. In this connection, the outer surface of the second connecting end (22) is tightly pressed by the inner surface of the straight part (11), and thus no backlash is allowed.

[0110] The above constitution prevents stress from concentrating on specific parts of the cane (7), such as the above-described connecting ends, and enhances the mechanical strength of the junctions, on which stress tends to concentrate, by sufficient reinforcement with the external joint covers (5). Therefore, the cane (7) has less risk of breaking due to such a stress concentration and less risk of the user's falling, can be safely used, and thus is preferable. Further, since there is no backlash, the connecting ends are prevented from early wear-out due to mutual friction at the time of connection/separation, and therefore the durability of the cane (7) is increased. Further, the axis of the cane (7) does not bend during use, and thus the user can use the cane with a sense of security. For the shaft parts (14), special structures such as screw clamps in connecting ends are not needed since only insertion/removal of the connecting ends and the smaller-diameter part (9) provided thereon are needed at the time of connection/separation. Therefore, the shaft parts (14) have a simple structure, can be produced at low cost, allow easy connection/separation, and thus are preferable.

[0111] In the third embodiment, one end of the joint cover (5) is fixed to the first connecting end (21), and the second connecting end (22) can be inserted into and removed from the other end of the joint cover (5). Alternatively, in the present invention, it is possible that one end of the joint cover (5) is fixed to the second connecting end (22) of the shaft part (14) not provided with a smaller-diameter part, and that the first connecting end (21) of the opposite shaft part (14) provided with a smaller-diameter part can be inserted into and removed from the other end of the joint cover (5).

[0112] According to the third embodiment, the ferrule (6) is a standard type, that is, in a cylindrical shape with a smoothly curved surface in the lower part. The upper part has a curved surface that has a diameter gradually decreasing toward the upper end and is continued to the outer surface of the shaft (4). As is the case with the first embodiment, the ferrule (6) is formed of a high-strength organic fiber-reinforced resin and has a joint hole (25) as a recess in the upper end, and the lower end of the shaft (4) is fitted into the joint hole (25) and fixed thereto. Other constitutions, such as the grip (1), are the same as those of the first embodiment and function similarly. Therefore, descriptions therefor will be omitted.

[0113] In the above embodiments, canes (7) with a so-called I-shaped grip (1) are described. However, the cane of

the present invention may have a grip (1) of other shapes such as modified example 1 shown in FIG. 10. For example, FIG. 10 (a) shows a cane (7) provided with a so-called T-shaped grip (1), FIG. 10 (b) shows a cane (7) provided with a so-called L-shaped grip (1), and in both cases, the grip (1) is extended from the upper end of the shaft (4).

[0114] In the first embodiment, a teardrop type ferrule is used, and in the third embodiment, a standard type ferrule is used. However, the ferrule (6) used for the present invention is not limited to specific shapes unless the use as a cane is hindered. For example, the above standard type ferrule may be used in a straight cane as illustrated in the first embodiment, and the above teardrop type ferrule may be used in a folding cane as illustrated in the third embodiment. In addition, for example, like modified example 2 shown in FIG. 11, the above standard type ferrule can be a standard type ferrule (6) which has a shoulder and has a smaller diameter in the upper part to reduce the risk of being caught in other objects.

EXAMPLES

[0115] Hereinafter, the present invention will be illustrated in more detail by examples and comparative examples, but is not limited to the examples below.

Example 1

[0116] As a high-strength organic fiber, a poly(p-phenylene terephthalamide) fiber, KEVLAR K-29 1670 dtx (manufactured by DU PONT-TORAY CO., LTD.) was used. From this organic fiber, a unidirectional (UD) sheet with a fiber areal weight of 73 g/m² was prepared, and the sheet was impregnated with an epoxy resin by a hot melt method in such a manner that the fiber-resin content ratio might be 67:33. In this way, a high-strength organic fiber prepreg with a fiber areal weight of 110 g/m² was obtained. As a carbon fiber prepreg, TORAYCA (registered trademark) prepreps (type: 9052S-17 and 3252S-05, manufactured by Toray Industries, Inc.) were used. Each of these prepreps is a carbon fiber prepreg with a fiber areal weight of 330 g/m² and is produced by impregnating a UD sheet with a fiber areal weight of 220 g/m² with an epoxy resin in such a manner that the fiber-resin content ratio may be 67:33.

[0117] As a glass fiber, a glass fabric, WPA-240D (manufactured by Nitto Boseki Co., Ltd.), which is a UD sheet with a fiber areal weight of 100 g/m², was used, and the glass fabric was impregnated with an epoxy resin by a hot melt method in such a manner that the fiber-resin content ratio might be 67:33. In this way, a glass fiber prepreg with a fiber areal weight of 150 g/m² was obtained.

[0118] Next, one layer of the glass fiber prepreg as the innermost layer, three layers of the high-strength organic fiber prepreg, one layer of the carbon fiber prepreg, two layers of the high-strength organic fiber prepreg, and one layer of the glass fiber prepreg were laminated in this order, integrated and cured with heat. Around the surface of the cured product, a reflective tape was attached and a 0.06-mm-thick HIMILAN film (trade name, manufactured by DU PONT-MITSUI POLYCHEMICALS) as a wear-resistant transparent resin film was laminated to cover the tape. In this way, a cylindrical body of Example 1 was obtained.

Comparative Example 1

[0119] According to the procedures of Example 1 except using the above-mentioned carbon fiber prepreg instead of the

high-strength organic fiber prepreg and the glass fiber prepreg of Example 1, a cylindrical body of Comparative Example 1 was obtained.

Comparative Example 2

[0120] According to the procedures of Example 1 except using the above-mentioned high-strength organic fiber prepreg instead of the carbon fiber prepreg and the glass fiber prepreg of Example 1, a cylindrical body of Comparative Example 2 was obtained.

[0121] Regarding each of the obtained cylindrical bodies, the outer diameter was 12 mm and the cross-sectional area ratio of the hollow and the shell was 67:33.

[0122] Next, these cylindrical bodies were measured for stiffness (flexural property), impact resistance, safety and on-site repairability, and the respective characteristic values were determined. The measurement was performed according to the following methods.

<Stiffness (Flexural Property)>

[0123] Each cylindrical body in the above-mentioned Example and Comparative Examples was supported by two fulcrum points the distance between which was 780 mm, and a 3-kg weight was hooked on the cylindrical body in the middle between the fulcrum points and left to stand for 10 seconds. The degree (mm) that the cylindrical body bent in response to the weight was measured.

<Impact Resistance>

[0124] A 30-cm piece was cut from each cylindrical body in Example and Comparative Examples and used as a sample. According to the three point flexural test specified in JIS K 7055:1995 (Testing method for flexural properties of glass fiber-reinforced plastics), using a Drop Weight Impact Tester (trade name: Dynatup (registered trademark) 9210, manufactured by Instron), the sample was fixed by two fulcrum points the distance between which was 105 mm, and given an impact force of 110J by use of an indenter 22 mm in diameter. The fracture condition, the absorbed energy, etc. of each sample were determined.

[0125] The evaluation criteria for the fracture condition are as follows.

A: Not fractured

B: Partially fractured

C: Easily and completely fractured

<Safety>

[0126] After the impact resistance test, the safety was evaluated based on the presence or absence of spiky fibers projected from the impact site of each cylindrical body.

[0127] The evaluation criteria for the safety are as follows.

A: There were no spiky fibers projected and sufficient safety was confirmed.

B: There were a few spiky fibers projected.

C: There were spiky fibers projected and they might get stuck in the hand.

<On-Site Repairability>

[0128] After the impact resistance test, the fractured or damaged site was repaired by use of an emergency repair kit for domestic white canes (trade name: YATSUHASHI-KUN; product number: 39032) distributed by the Tool Sales Divi-

sion of Japan Braille Library, and the on-site repairability was evaluated based on whether the repaired cylindrical body was usable as a cane shaft. This emergency repair kit (26) contains one pair of semicylindrical supporting plates (13), for example, as shown in FIG. 12. Repair of a fractured shaft (4) by use of this emergency repair kit (26) is performed as follows. The release tape of a double-sided tape (12) stuck on the back of each supporting plate (13) is stripped off, the two supporting plates (13) are attached onto the fractured shaft in such a manner that the fracture site of the shaft (4) is centered on the length of each supporting plate and is sandwiched in between the supporting plates, and accessory reflective tapes (15) are attached over the upper and lower ends of the supporting plates (13) to firmly fix the supporting plates to the cylindrical body. In this way, the fractured shaft comes into the state as shown in FIG. 13. The evaluation criteria of the on-site repairability are as follows.

A: After impact was given, simple repair on site reproduced a usable cane.

C: After impact was given, simple repair on site was not applicable and did not reproduce a usable cane.

[0129] The measurement results of the above-mentioned characteristic values are as shown in Measurement Result Comparison Table 1 in FIG. 14.

[0130] As is clear from the measurement results, Comparative Example 1 formed of only a carbon-fiber-reinforced-resin layer had a high stiffness, but was not enough in impact resistance against a force in a direction perpendicular to the axis of the cylindrical body. Also, at the time of impact, Comparative Example 1 fractured with spiky fibers projected, and thus was not excellent in safety or on-site repairability. Comparative Example 2 formed of only a high-strength-organic-fiber-reinforced-resin layer had an excellent impact resistance and did not fracture at the time of impact, and thus was excellent in safety and on-site repairability. However, the flexural degree was high when the load was applied in a direction perpendicular to the axial direction, and thus the stiffness was low.

[0131] By contrast, Example 1 of the present invention was more excellent in stiffness than Comparative Example 2. In addition, Example 1 bent only slightly at the time of impact and thus was excellent in impact resistance against a force in a direction perpendicular to the axis of the cylindrical body. Moreover, Example 1 did not allow spiky fibers to be projected from the impact site and thus was excellent in safety, and did not fracture and thus was also excellent in on-site repairability.

[0132] Example 1 of the present invention, which comprises a glass-fiber-reinforced-resin layer inside, is excellent in wear resistance of the inner surface unlike Comparative Example 2, which comprises only layers made of a high-strength organic fiber prepreg. For example, in the case of a folding cane having a rubber cord arranged inside its shaft, the shaft ends are prevented from early wear-out due to the friction against the rubber cord.

[0133] Since Example 1 had a wear-resistant transparent resin film laminated to cover a reflective tape attached around the outer surface of the cylindrical body, it was expected that Example 1 would be much more excellent in wear resistance of the outer surface and thus could be more favorably prevented from wear-out of the reflective tape, as compared with conventional products without the film. For confirmation of these effects, the wear resistance of the outer surface was measured according to the following method.

<Wear Resistance of Outer Surface>

[0134] An abrasive cloth sheet 25 mm in width and 300 mm in length (grain size: #240, manufactured by Noritake Coated Abrasive Co., Ltd.) was used. As shown in FIG. 15, the shaft (4) was kept in a horizontal position, the abrasive cloth sheet (36) was horizontally and vertically placed in the 90-degree direction to the axis of the shaft (4) in such a manner that the sheet was in contact with a quadrant part (90-degree part) of the shaft (4) surrounded by the upper horizontal plane and the vertical plane. Under the condition that a 330-g weight (37) was hung on the lower end of the upright portion of the abrasive cloth sheet (36), the abrasive cloth sheet (36) was moved 200 mm against the shaft at the speed of 2 seconds per stroke to abrade the surface of the shaft (4).

[0135] As a result of the measurement, in the case where the reflective tape was externally exposed without the wear-resistant transparent resin film, the superficial reflective tape was worn out in five strokes and the glass-fiber-reinforced-resin layer under the tape was exposed. By contrast, in the case of Example 1 of the present invention, which had a wear-resistant transparent resin film laminated onto the outside surface of the reflective tape, the reflective tape was not worn out at all even after 100 strokes.

[0136] Next, a teardrop type ferrule (6) was attached to the cylindrical body of Example 1 and the resulting product was regarded as Example 2. For examination of the usage characteristics of this ferrule (6), the information transmission performance and the manipulability were tested by use of the actual road surfaces shown in FIG. 16, and the antisticking property (smooth mobility over the uneven surface) was tested by use of antislip parts of stairs, gaps on the road surface, etc. For the test, three kinds of road surfaces were used, that is, an asphalt pavement surface shown in FIG. 16 (a), a concrete pavement surface arranged with gravels shown in FIG. 16 (b), and a concrete pavement surface with a tiled pattern shown in FIG. 16 (c).

[0137] From a high-strength-organic-fiber-reinforced-resin material, the above-mentioned ferrule (6) was formed in a teardrop shape 26.1 mm in maximum outer diameter and 40.4 mm in length. Then, the lower end of the shaft (4) 12.5 mm in outer diameter was inserted into a joint hole (25) 13 mm in inner diameter formed in the upper end of this ferrule (6) and fixed thereto with an adhesive. The high-strength-organic-fiber-reinforced-resin material was one in which staple fibers of a poly(p-phenylene terephthalamide) fiber were dispersed in a polyamide resin (Nylon 6), and was obtained by cutting 1.7-dtex filaments of the poly(p-phenylene terephthalamide) fiber into 6-mm pieces, and then dispersing the pieces in the polyamide resin. The high-strength-organic-fiber-reinforced-resin material contained 70 mass % of the polyamide resin and 30 mass % of the poly(p-phenylene terephthalamide) fiber.

<Information Transmission Performance>

[0138] It was tested whether the cane is capable of transmitting information on road surface conditions such as unevenness and smoothness to the user. In the case where the user examining the road surface could detect the differences of the road surfaces, the subject cane was evaluated as "good," and in the case where the user could not detect such differences, the subject cane was evaluated as "poor."

<Manipulability>

[0139] The burden given to the hand and wrist when the user swung around the cane or poked the road surface etc. with the cane was measured. In addition, the sound level was measured when the ferrule touched the road surface. In the case where the subject cane in use gave less burden to the hand and wrist and did not make a loud sound, the subject cane was evaluated as "good," and in the case where the burden was heavy and the sound was loud, the subject cane was evaluated as "poor."

<Antisticking Property>

[0140] It was tested whether or not the subject cane would be stuck to or caught in antislip parts of stairs, gaps on the road surface, etc. In the case where the subject cane was not stuck or caught, the subject cane was evaluated as "good," and in the case where the subject cane was stuck or caught, the subject cane was evaluated as "poor."

[0141] Regarding the above-mentioned usage characteristics, the measurement results in comparison with conventional ferrules for canes are shown in Measurement Result Comparison Table 2 in FIG. 6.

[0142] Each conventional ferrule used for the comparison was made of a polyamide resin (PA6), a standard type was regarded as Comparative Example 3, a teardrop type was regarded as Comparative Example 4, and a palm tip type was regarded as Comparative Example 5. The palm tip type as Comparative Example 5 was one having an elastic member between the shaft and the grounding part of the ferrule, as described in, for example, the WO 07/058180 pamphlet. Specifically, the one having an elastic member made of chloroprene rubber between the shaft and the grounding part made of a polyamide resin was used.

[0143] As is clear from the results of the above-mentioned measurement, Comparative Examples 3 to 5 did not enable easy recognition of the kind of the road surface, and thus were poor in information transmission performance. By contrast, Example 2 of the present invention enabled easy recognition of the three kinds of road surfaces, and thus was extremely excellent in information transmission performance.

[0144] Specifically, while using any of Comparative Examples 3 to 5, the user had a feel that the ferrule stuck to the road surface as if writing letters with a crayon, and thus could not easily detect the kind of the road surface. By contrast, while using Example 2 of the present invention, the user had a feel that the ferrule lightly touched the road surface and slightly bounced back therefrom as if writing letters with a pencil, and the feel clearly varied with the kind of the road surface.

[0145] Further, Example 2 of the present invention was more excellent in manipulability than not only Comparative Example 4 but also Comparative Examples 3 and 5.

[0146] Specifically, while manipulating Comparative Example 4, the user was given a heavy burden to the hand and wrist, and thus the manipulability was poor. Regarding Comparative Examples 3 and 5, the burden was lighter than that of Comparative Example 4, and thus the manipulability was favorable. By contrast, regarding Example 2 of the present invention, the ferrule favorably reacted against the road surface to be examined, and thus the user was less required to excessively swing around the cane or poke about therewith, and was given further less burden to the hand and wrist than that in Comparative Examples 3 and 5. In addition, the sound

generated when the user hit the road surface with the cane was not so loud, and thus the manipulability was extremely favorable.

[0147] Next, the wear resistance of the ferrule (6) was measured. The test product was made of the high-strength-organic-fiber-reinforced-resin material used for the standard type ferrule adopted in the third embodiment and was regarded as Example 3. This high-strength-organic-fiber-reinforced-resin material consists of a polyamide resin (66 nylon) reinforced with staple fibers of a poly(p-phenylene terephthalamide) fiber, which is a high-strength organic fiber. The content ratio of the high-strength organic fiber to the fiber-reinforced resin is 30 mass %. As the comparative test products, a molded product made of a polypropylene resin (PP) alone and a molded product made of a polyamide resin (Nylon 6) alone were used and regarded as Comparative Examples 6 and 7, respectively.

[0148] The test method was in accordance with method A specified in JIS K 7218:1986 (Testing methods for sliding wear resistance of plastics) and the following conditions were adopted.

Test piece: ring (hollow cylindrical shape)

Opponent material: SUS304 ring (hollow cylindrical shape)

The surface roughness was adjusted by finishing with #1000 abrasive paper (0.1 μmRa >).

Measurement item: wear mass

Measurement conditions

[0149] Sliding speed: 500 mm/second

[0150] Friction area: 2 cm^2

[0151] Test load: 100 N

[0152] Test time: 100 minutes (3 km)

[0153] Number of measurement: n=1

Laboratory environment: temperature: $23\pm 2^\circ\text{C}$., humidity: $50\pm 10\%$ RH

Measuring device: rotary tribometer for kinetic friction and wear tests, IIT-2000-5000N model (manufactured by Takachiho-seiki Co., LTD.)

[0154] The test results are as shown in Measurement Result Comparison Table 3 in FIG. 18.

[0155] As is clear from the test results, Comparative Example 6 formed of polypropylene resin was worn out at the early stage, and Comparative Example 7 formed of polyamide resin showed a large wear mass and was frictionally heated, resulting in resin melting in the middle of the test. By contrast, since the high-strength organic fiber-reinforced resin was used in Example 3 of the present invention, constant wear was maintained till the end of the test and even the constant wear mass was slight. Accordingly, it was confirmed that the ferrule of the present invention formed of a high-strength organic fiber-reinforced resin is excellent in wear resistance.

[0156] The canes and the cylindrical bodies used therefor described in the above-mentioned embodiments are illustrated in order to embody the technical ideas of the present invention. Therefore, the shape, the dimension, the number of layers, etc. of each component are not limited to those specified in these embodiments, and various modifications can be made within the scope of the claims.

[0157] For example, the shaft and the grip are integrally formed in the first embodiment, but in the present invention, they may be separately formed and fixed to each other.

[0158] Regarding the folding cane of the third embodiment, a case where joint covers are provided at all the junctions of shaft parts is described. However, in the present invention, the

joint cover may be omitted at any junction. For example, the joint cover may be provided only at the lowermost junction, which is prone to break, not at the other junctions.

[0159] In each of the above-mentioned embodiments, the indicating layers are a reflective tape and a colored tape. However, in the present invention, other kinds of indicating layers may be used and these indicating layers may be omitted.

[0160] In the above-mentioned embodiments, a poly(p-phenylene terephthalamide) fiber is used as a high-strength organic fiber, but it will be understood that other kinds of high-strength organic fibers may be also used in the present invention.

INDUSTRIAL APPLICABILITY

[0161] The cane of the present invention is useful as a cane for sports such as mountain climbing and skiing or for ordinary walking, as well as a white cane for the visually disabled. Further, the cane of the present invention gives less physical burden to the user, is greatly beneficial in particular to the elderly, juniors and the visually disabled, and is also helpful to facilitate self-support, to increase social participation of people in need of nursing care, and to improve labor productivity.

REFERENCE SIGNS LIST

- [0162]** 1 . . . Grip
- [0163]** 4 . . . Shaft
- [0164]** 5 . . . Joint cover
- [0165]** 6 . . . Ferrule
- [0166]** 7 . . . Cane
- [0167]** 9 . . . Smaller-diameter part (inner pipe)
- [0168]** 14 . . . Shaft part
- [0169]** 17 . . . Hollow
- [0170]** 18 . . . Shell
- [0171]** 19 . . . Grip body
- [0172]** 20 . . . Antislip member
- [0173]** 21 . . . First connecting end
- [0174]** 22 . . . Second connecting end
- [0175]** 31 . . . High-strength-organic-fiber-reinforced-resin layer
- [0176]** 31a . . . First high-strength-organic-fiber-reinforced-resin layer
- [0177]** 31b . . . Second high-strength-organic-fiber-reinforced-resin layer
- [0178]** 32 . . . Carbon-fiber-reinforced-resin layer
- [0179]** 33 . . . Glass-fiber-reinforced-resin layer
- [0180]** 33a . . . First glass-fiber-reinforced-resin layer
- [0181]** 33b . . . Second glass-fiber-reinforced-resin layer
- [0182]** 34 . . . Indicating layer
- [0183]** 35 . . . Wear-resistant transparent resin layer

1. A cane having a shaft and a grip provided at the upper end of the shaft,

the shaft comprising a high-strength-organic-fiber-reinforced-resin layer and a carbon-fiber-reinforced-resin layer,

the high-strength-organic-fiber-reinforced-resin layer being integrally laminated onto at least the outside surface of the carbon-fiber-reinforced-resin layer.

2. The cane according to claim 1, wherein the high-strength-organic-fiber-reinforced-resin layer is integrally laminated onto each of the outside and inside surfaces of the carbon-fiber-reinforced-resin layer.

3. The cane according to claim 1, wherein the high-strength organic fiber is a para-aramid fiber.

4. The cane according to claim 1, wherein the shaft comprises a glass-fiber-reinforced-resin layer on the inner side of the innermost high-strength-organic-fiber-reinforced-resin layer.

5. The cane according to claim 1, wherein the shaft comprises a glass-fiber-reinforced-resin layer on the outer side of the outermost high-strength-organic-fiber-reinforced-resin layer.

6. The cane according to claim 1, wherein the shaft comprises an indicating layer on the outer side of the outermost high-strength-organic-fiber-reinforced-resin layer.

7. The cane according to claim 6, wherein a cylindrical glass-fiber-reinforced-resin layer is provided on the outer side of the indicating layer.

8. The cane according to claim 6, wherein a wear-resistant transparent resin layer is provided on the outer side of the indicating layer.

9. The cane according to claim 1, wherein the shaft is hollow-structured, and in the cross-section perpendicular to the axis of the shaft, the cross-sectional area ratio of a hollow and a shell surrounding the hollow is 85:15 to 56:44.

10. The cane according to claim 1, wherein the shaft consists of a plurality of mutually connectable and separable shaft parts, and in the shaft parts adjacent to each other, a first connecting end of one shaft part is provided with a smaller-diameter part that can be inserted into and removed from a second connecting end of the opposite shaft part.

11. The cane according to claim 10, wherein the smaller-diameter part is formed of a high-strength-organic-fiber-reinforced-resin layer.

12. The cane according to claim 10, wherein a cylindrical joint cover is provided to cover the first connecting end and the second connecting end which are connected to each other, one end of the joint cover being fitted onto one of the first and second connecting ends and fixed thereto, the other end of the joint cover being configured such that the other connecting end can be inserted thereinto and removed therefrom.

13. The cane according to claim 1, wherein the grip has a hollow-structured grip body extended from the upper end of the shaft, and the cross-section perpendicular to the axis of the grip body is larger than that of the shaft.

14. The cane according to claim 1, wherein the grip is formed of a high-strength fiber-reinforced resin.

15. The cane according to claim 1, wherein the grip has an antislip member on at least part of the outer surface thereof.

16. A cane having a shaft and a ferrule attached to the lower end of the shaft,

the ferrule being formed of a high-strength organic fiber-reinforced resin in which staple fibers of a high-strength organic fiber are dispersed in a synthetic resin.

17. The cane according to claim 16, wherein the ratio of the high-strength organic fiber in the high-strength organic fiber-reinforced resin is 10 to 60 mass %.

18. The cane according to claim 16, wherein the staple fibers dispersed in the synthetic resin have a filament fineness of 1.1 to 2.3 dtex and a fiber length of 2 to 8 mm.

19. The cane according to claim 16, wherein the shaft comprises a high-strength-organic-fiber-reinforced-resin layer and a carbon-fiber-reinforced-resin layer, the high-strength-organic-fiber-reinforced-resin layer being integrally laminated onto at least the outside surface of the carbon-fiber-reinforced-resin layer.

20. The cane according to claim 1, wherein the cane is a white cane.

21. A cylindrical body comprising a cylindrical high-strength-organic-fiber-reinforced-resin layer and a cylindrical carbon-fiber-reinforced-resin layer,

the high-strength-organic-fiber-reinforced-resin layer being integrally laminated onto at least the outside surface of the carbon-fiber-reinforced-resin layer.

22. The cylindrical body according to claim 21, wherein the high-strength-organic-fiber-reinforced-resin layer is integrally laminated onto each of the outside and inside surfaces of the carbon-fiber-reinforced-resin layer.

23. The cylindrical body according to claim 21, wherein the high-strength organic fiber is a para-aramid fiber.

24. The cylindrical body according to claim 21, comprising a glass-fiber-reinforced-resin layer on the inner side of the innermost high-strength-organic-fiber-reinforced-resin layer.

25. The cylindrical body according to claim 21, comprising a cylindrical glass-fiber-reinforced-resin layer on the outer side of the outermost high-strength-organic-fiber-reinforced-resin layer.

26. The cylindrical body according to claim 21, wherein, in the cross-section perpendicular to the axis of the cylindrical body, the cross-sectional area ratio of a hollow and a shell surrounding the hollow is 85:15 to 56:44.

27. The cylindrical body according to claim 21, which is used as a shaft of a cane having a grip provided at the upper end of the shaft.

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