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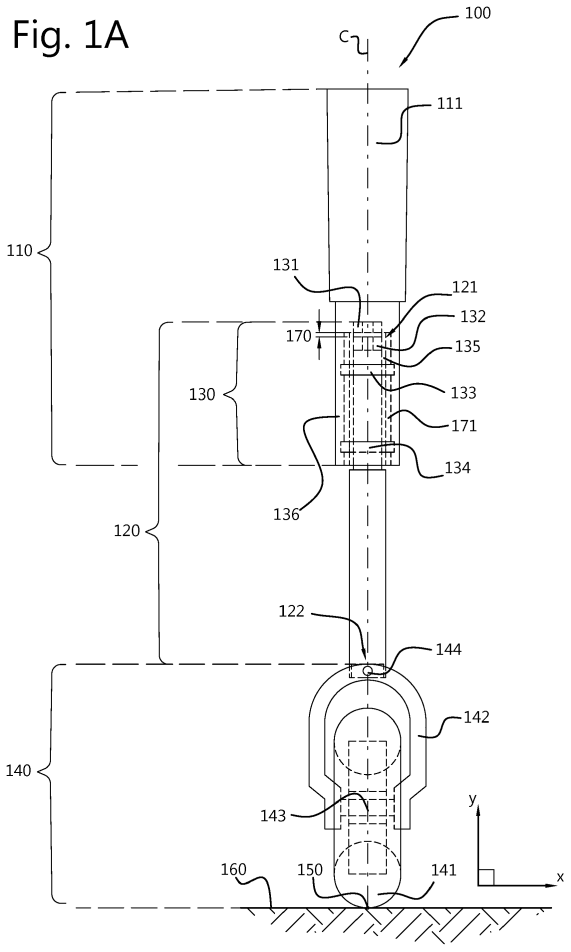
(54) A CANE FOR GUIDING A VISUALLY IMPAIRED USER

(57) The present invention relates to a cane (100) configured to assist a visually impaired user when traveling on foot, the cane comprising an elongated tubular body (120) having a first end part (121) and a second end part (122), a grip area (110) associated with the first end part and a tactile unit (140) associated with the second end part. The tactile unit comprises a wheel (141) and a biasing arrangement (130) configured to enable the wheel to stay in a first position, when a first force applied by the user to the grip area in a direction transverse to a longitudinal central axis (C) of the elongated tubular body is smaller than a predefined threshold, and to enable the wheel to assume a second position that is different from the first position when a second force that is applied to the grip area in the direction transverse to the longitudinal central axis is at or above the predefined threshold.

Fig. 1A



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Description

FIELD OF THE INVENTION

[0001] The invention relates to a cane configured to assist a visually impaired user when traveling on foot.

BACKGROUND OF THE INVENTION

[0002] A cane or white stick is a commonly known aid used by visually impaired persons for determining the walkability of a walkway and finding their way when traveling on foot. The cane typically comprises an elongated tubular body having two opposing ends parts. A visually impaired user holds one of these end parts in at least one of his hands while the opposing, free end part is used as a contacting tool. By at least one of tapping and moving the free end part over a surface of the walkway, the visually impaired user can detect obstacles, such as street furniture, pits or holes in the surface of the walkway, walls or trees in or along the walkway, which preferably are to be avoided. The typical tapping sound of the free end part of the cane can also alert persons in the vicinity of the visually impaired user.

[0003] When walking, a visually impaired user will point the free end part of the cane towards the surface of the walkway and will scan the surface of the walkway typically by swinging the cane from side to side to detect possible obstacles. Swinging of the cane involves at least one of twisting and moving at least one of the user's wrist, hand, arm and shoulder. Therefore, prolonged swinging of the cane is stressful and tiring. Moreover, it can cause injuries at least to the user's wrist and/or muscles of the user's hand and/or arm.

[0004] Based on the above, there is a need for a cane that enables improved ergonomic use and therefore reduce the risk of injuries.

SUMMARY OF THE INVENTION

[0005] It is an object of the present invention to provide a cane that pre-empts or at least reduces the abovementioned disadvantage and/or other disadvantages associated with known canes.

[0006] Aspects of the present invention are set out in the accompanying independent and dependent claims. Features from the dependent claims may be combined with features from the independent claim as appropriate and not merely as explicitly set out in the claims.

[0007] At least one of the abovementioned objects is achieved by a cane configured to assist a visually impaired user when traveling on foot, the cane comprising:

- an elongated tubular body having a first end part and a second end part;
- a grip area that is associated with the first end part of the elongated tubular body and is configured to be held by said user within at least one of his hands when using the cane;
- a tactile unit that is associated with the second end part of the elongated tubular body, the tactile unit comprising a wheel that in use of the cane is positioned on a surface of a walkway and is configured to provide information to said user, wherein the information is indicative for a walkability of the walkway, wherein the wheel is in a first position when a first distance between a first point on a tread of the wheel with which the wheel is in contact with the surface of the walkway and the center of the wheel is largest; and
- a biasing arrangement that is configured to enable the wheel to assume the first position when a first force that is applied by said user to the grip area in a direction transverse to a longitudinal central axis of the elongated tubular body is smaller than a predefined threshold, and wherein the biasing arrangement is configured to enable the wheel to assume a second position that is different from the first position when a second force that is applied by said user to the grip area in the direction transverse to the longitudinal central axis of the elongated tubular body is at or above the predefined threshold.

[0008] In this way, a cane is provided that does not require twisting of at least one of the user's wrist, hand and arm for swinging the cane. Instead, as a result of the application of a second force to the grip area in a direction transverse to the longitudinal central axis of the elongated tubular body, wherein the second force is at or above the predefined threshold, the biasing arrangement allows the wheel to change from the first, neutral position to the second, slanted or skewed position. In this way, the cane can be swung sideways. When a first force is applied to the grip area in a direction transverse to the longitudinal central axis of the elongated tubular body that is smaller than the predefined threshold or in the event that no force is applied to the grip area in a direction transverse to the longitudinal central axis of the elongated tubular body, the biasing arrangement will force the wheel back to its first, neutral position. In this way, the cane will stop moving sideways. By applying another force to the grip area in a direction transverse to the longitudinal central axis of the elongated tubular body in an opposite direction as the second force mentioned above, wherein said another force

is at or above the predefined threshold, the biasing arrangement allows the wheel to change from the first, neutral position to the second, slanted or skewed position. In this way, the cane can be swung sideways in a direction opposite to the direction in response to the application of the second force.

[0009] The person skilled in the art will appreciate that the use of the cane according to the invention is less stressful and tiring for the user than the use of known canes. Therefore, the cane according to the invention reduces at least the risk of injuries to at least one of the user's wrist and the muscles of at least one of the user's hand, arm and shoulder. In addition, it has been found that over-development of the muscles of at least one of the user's hand and arm can be prevented by using the cane according to the present invention.

[0010] The wheel of the cane according to the invention may comprise a material that is selected from a group of materials including plastics, composite materials, ceramics or metals. The person skilled in the art will appreciate that the tread of the wheel of the cane according to the invention must have a rounded shape like that of a wheel of a motor bike.

[0011] The tactile unit may include a driving shaft that connects the biasing mechanism with the wheel. The driving shaft may include a suspension unit that is connected with the wheel and configured to improve suspension of the wheel. As a result, shocks caused by obstacles encountered in or on the surface of the walkway can advantageously be absorbed.

[0012] In an embodiment of the cane according to the invention, the grip area and the first end part of the elongated tubular body are connected with respect to each other such that they are rotatable with respect to each other around the longitudinal central axis of the elongated tubular body. In this way the elongated tubular body can be rotated with respect to the grip area when the second force that is applied by the user to the grip area in a direction transverse to the longitudinal central axis of the elongated tubular body is at or above the predefined threshold. As mentioned above, in that case the biasing arrangement allows the wheel to change from the first, neutral position to the second, slanted or skewed position without requiring twisting of at least one of the user's wrist, hand, arm and shoulder.

[0013] In an embodiment of the cane according to the invention, the grip area comprises a first unit of the biasing arrangement and the first end part of the elongated tubular body comprises a second unit of the biasing arrangement, the first unit of the biasing arrangement comprising a first magnet and the second unit of the biasing arrangement comprising a second magnet, wherein when the wheel is in the first position the respective opposing poles of the first magnet and the second magnet face each other. In the event that a second force is applied by the user to the grip area in a direction transverse to the longitudinal central axis of the elongated tubular body, wherein the second force is at or above the predefined threshold, the opposing poles, i.e. north and south poles, of the first and second magnets get misaligned as they are moved away from each other. As a result, the first magnet and the second magnet want to restore the situation in which their opposing poles are aligned. When the opposing poles of the first and second magnets are aligned, the wheel is in the first, neutral position. When the opposing poles of the first and second magnets are misaligned, the wheel is in the second, slanted or skewed position. The person skilled in the art will appreciate that any suitable kind of magnets can be used, including for example ring magnets or bar magnets. Furthermore, any suitable combination of suitable kinds of magnets can be used, for example a combination of at least one ring magnet and at least one bar magnet.

[0014] In an embodiment of the cane according to the invention, the first magnet and the second magnet are arranged to be movable with respect to each other.

[0015] In this way, an air gap between the first and the second magnets can be changed, i.e. increased or decreased, in order to adjust the magnetic force that determines the predefined threshold that must be overcome by the second force that is applied by the user to the grip area in the direction transverse to the longitudinal central axis of the elongated tubular body in order to change the position of the wheel from the first, neutral position to the second, skewed or slanted position.

[0016] In an embodiment of the cane according to the invention, the biasing arrangement comprises a spring mechanism that is configured to allow the wheel to be movable from the first position to the second position in response to the second force and to be movable from the second position to the first position in response to application of the first force. In this way, a spring mechanism can be used instead of magnets to implement the biasing arrangement of the cane according to the invention. The spring mechanism may include a linear bearing that is adapted to convert a rotational movement of the elongated tubular body into a linear movement of the spring mechanism. When the wheel is in the first position, the spring mechanism may be released. The spring mechanism may be compressed when the user applies a second force that is at or above the predefined threshold to the grip area in the direction transverse to the longitudinal central axis of the elongated tubular body in order to change the position of the wheel from the first, neutral position to the second, skewed or slanted position. When a first force that is smaller than the predefined threshold is applied to the grip area in the direction transverse to the longitudinal central axis of the elongated tubular body, the spring mechanism allows the wheel to return to the first, neutral position.

[0017] In an embodiment of the cane according to the invention, the spring mechanism comprises a spring that is in a compressed state when the wheel is in the second position. The spring can be any suitable type of spring, for example a torsion spring.

[0018] In an embodiment of the cane according to the invention, the spring is in a released state when the wheel is in the first position.

[0019] In an embodiment of the cane according to the invention, the spring mechanism is associated with the first magnet and the second magnet. In this way, a hybrid biasing mechanism may be obtained that has improved tuning possibilities for adjusting the abovementioned threshold to the individual requirements of the user.

[0020] In an embodiment of the cane according to the invention, the grip area is provided with a slot that is arranged to cooperate with the first end part of the elongated tubular body. In this way, the biasing arrangement enables rotation of the elongated tubular body when the user applies the second force that is at or above the threshold to the grip area in a direction transverse to the longitudinal central axis of the elongated tubular body. As a result, the wheel is allowed to change from the first, neutral position to the second, slanted or skewed position.

[0021] In an embodiment of the cane according to the invention, the spring mechanism further comprises an axel that is adapted to move in the slot in response to the application of the first force or application of the second force.

[0022] In an embodiment of the cane according to the invention, the elongated tubular body is configured to move the wheel from the first position to the second position in a same direction as the direction transverse to the longitudinal central axis of the elongated tubular body in which the second force is applied. In this way, as seen from the perspective of the user, the wheel can be slanted or skewed to the left when the user applies the second force to the left. In a similar way, as seen from the perspective of the user, the wheel can be slanted or skewed to the right when the user applies the second force to the right.

[0023] In an embodiment of the cane according to the invention, the elongated tubular body is configured to move the wheel from the first position to the second position in a direction that is opposite to the direction transverse to the longitudinal central axis of the elongated tubular body in which the second force is applied. In this way, as seen from the perspective of the user, the wheel can be slanted or skewed to the left when the user applies the second force to the right. In a similar way, as seen from the perspective of the user, the wheel can be slanted or skewed to the right when the user applies the second force to the left.

[0024] In an embodiment of the cane according to the invention, the grip area further comprises a handle that is associated with the elongated tubular body via a fixation mechanism. In this way, the handle can be oriented in any desirable way with respect to the elongated tubular body. The fixation mechanism can be any suitable releasable mechanism including any one of cooperating bolts, nuts, axles or levers.

[0025] In an embodiment of the cane according to the invention, the fixation mechanism is adapted to allow a releasable fixation of the handle at least when the handle is in an operational position with respect to the elongated tubular body, the handle being in the operational position when a first angle is present between a longitudinal central axis of the handle and the longitudinal central axis of the elongated tubular body, the first angle being in a first range between 30° and 60°, preferably being equal to 45°, and a second angle is present between the longitudinal central axis of the handle and a central plane of the wheel as seen along the longitudinal central axis, the central plane of the wheel being oriented parallel to the longitudinal central axis of the elongated tubular body and perpendicular to an axial central axis of the wheel, the second angle being in a second range between 10° and 45°, preferably being equal to 30°.

[0026] The operational position of the handle enables the user when using the cane to hold the handle in his or her hand while being allowed to keep that hand in its neutral or so-called Neanderthal position. The neutral or Neanderthal position of a hand is favorable as in this position of the hand stressing of the wrist and the muscles of at least one of the hand, arm and shoulder can be reduced further. In this way, at least the risk of injuries to at least one of the wrist and the muscles of at least one of the hand, arm and shoulder can be reduced further. In addition, it has been found that over-development of the muscles of at least one of the user's hand and arm can be reduced further.

[0027] The person skilled in the art will appreciate that the actual values of the first angle and of the second angle depend on the user's physique.

[0028] The person skilled in the art will also appreciate that the fixation mechanism can also establish a releasable fixation of the handle when at least one of the first angle and the second angle are not within at least one of the first range and the second range. However, in such event the abovementioned advantages related to the operational position of the handle are less.

[0029] Furthermore, the person skilled in the art will appreciate that the operational position of the handle can be set for left-handed users and for right-handed users in a similar way.

[0030] In an embodiment of the cane according to the invention, the biasing arrangement further comprises, at least one bearing element that is configured to convert the second force that is applied by said user to the grip area in the direction transverse to the longitudinal central axis of the elongated tubular body into a rotational force that enables the wheel to be rotatable around the longitudinal central axis of the elongated tubular body to assume the second position.

[0031] In an exemplary embodiment of the cane according to the invention, the tactile unit may further comprise a position setting arrangement that is configured to set an orientation of the wheel with respect to the elongated tubular body when the wheel is in the first position. In this way the first, neutral position of the wheel can be set in accordance with the user's personal preference. For example, the user can set the wheel to be in a skewed position with respect to the elongated tubular body when being in the first, neutral position. However, the user can also choose to align the wheel with the elongated tubular body when being in the first, neutral position.

[0032] In another exemplary embodiment of the cane according to the invention, the position setting arrangement may comprise a bearing element that is associated with the wheel and is configured to enable the wheel to be rotatable around the longitudinal central axis of the elongated tubular body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] Further features and advantages of the invention will become apparent from the description of the invention by way of exemplary and non-limiting embodiments of a cane according to the present invention.

[0034] The person skilled in the art will appreciate that the described embodiments of the cane according to the present invention are exemplary in nature only and not to be construed as limiting the scope of protection in any way. The person skilled in the art will realize that alternatives and equivalent embodiments of the cane according to the present invention can be conceived and reduced to practice without departing from the scope of protection of the present invention.

[0035] Reference will be made to the figures on the accompanying drawing sheets. The figures are schematic in nature and therefore not necessarily drawn to scale. Furthermore, equal reference numerals denote equal or similar parts. On the attached drawing sheets,

figure 1A shows a schematic cross-sectional view of a first exemplary, non-limiting embodiment of a cane according to the invention, wherein a wheel of a tactile unit is in a first, neutral position, and wherein the cane comprises a first exemplary, non-limiting embodiment of a biasing arrangement;
figure 1B shows a schematic front view of the wheel of the cane shown in figure 1A, wherein the wheel is shown in the first, neutral position as shown in figure 1A and in a second, slanted or skewed position;
figure 1C shows a schematic cross-sectional view of the first exemplary, non-limiting embodiment of the cane from a different viewing angle;
figure 2 shows a schematic cross-sectional view of a second exemplary, non-limiting embodiment of the biasing arrangement of a cane according to the invention;
figure 3A shows a schematic cross-sectional view of a third exemplary, non-limiting embodiment of the biasing arrangement of a cane according to the invention;
figure 3B shows a schematic detailed view of a fourth exemplary, non-limiting embodiment of the biasing arrangement of a cane according to the invention;
figure 4A shows a schematic view of a second exemplary, non-limiting embodiment of a cane according to the invention; and
figure 4B shows a schematic top view of the second exemplary, non-limiting embodiment of the cane shown in figure 4A.

DETAILED DESCRIPTION OF EMBODIMENTS

[0036] Figure 1A shows a schematic cross-sectional view of a first exemplary, non-limiting embodiment of a cane 100 according to the invention comprising an elongated tubular body 120 having a first end part 121, a second end part 122 and a longitudinal central axis C.

[0037] The first end part 121 is provided with a grip area 110. In accordance with the first exemplary, non-limiting embodiment of the cane 100 shown in figure 1A, the grip area 110 includes a handle 111 that can be held by a user within at least one of his hands when using the cane 100.

[0038] The second end part 122 is provided with a tactile unit 140 that comprises a wheel 141. In use of the cane 100, the wheel 141 is positioned on a surface 160 of a walkway and is configured to provide the user with information that is indicative for a walkability of the walkway.

[0039] The cane 100 further comprises a biasing arrangement 130 that is configured to enable the wheel 141 to assume a first, neutral position as is shown in figure 1A. It is clear that in the first, neutral position, the wheel 141 is aligned with the elongated tubular body 120, i.e. a radial central axis of the wheel 141 is arranged in a same plane as the longitudinal central axis C of the elongated tubular body 120. The wheel 141 is in the first, neutral position when a first force, which is applied by the user to the grip area 110 in a direction transverse to the longitudinal central axis C of the elongated tubular body 120, is smaller than a predefined threshold.

[0040] The biasing arrangement 130 is configured to enable the wheel 141 to assume a second, slanted or skewed position, which is different from the first position, when a second force that is applied by the user to the grip area 110 in the direction transverse to the longitudinal central axis C of the elongated tubular body 120 is at or above the predefined threshold. The second, slanted or skewed position of the wheel 141 is shown in figure 1B.

[0041] The grip area 110 and the first end part 121 of the elongated tubular body 120 of the cane 100 shown in figure 1A are rotatable with respect to each other around the longitudinal central axis C of the elongated tubular body 120. As a result of that, the cane 100 as shown in figure 1A does not require twisting of at least one of the user's wrist, hand and

arm for swinging the cane 100. Instead, as a result of the application of the second force to the grip area 110 in a direction transverse to the longitudinal central axis C of the elongated tubular body 120, wherein the second force is at or above the predefined threshold, the biasing arrangement 130 allows the wheel 141 to change from the first, neutral position as shown in figure 1A to the second, slanted or skewed position as shown in figure 1B. In this way, the cane 100 can be swung sideways.

[0042] When a first force is applied to the grip area 110 in a direction transverse to the longitudinal central axis C of the elongated tubular body 120, wherein the first force is smaller than the predefined threshold or in the event that no force in a direction transverse to the longitudinal central axis C of the elongated tubular body 120 is applied to the grip area 110, the biasing arrangement 130 will force the wheel 141 back to its first, neutral position. In this way, the cane 100 will stop moving sideways. By applying another force to the grip area 110 in a direction transverse to the longitudinal central axis C of the elongated tubular body 120 in a direction opposite to the direction in which the aforementioned second force is applied, the biasing arrangement 130 allows the wheel 141 to change from the first, neutral position to the second, slanted or skewed position, when said another force is at or above the predefined threshold. In this way, the cane 100 can be swung sideways in a direction opposite to the direction in response to the application of the second force.

[0043] In accordance with the first exemplary, non-limiting embodiment of the cane 100 described above, the elongated tubular body 120 is configured to move the wheel 141 from the first, neutral position to the second, slanted or skewed position in a same direction as the direction transverse to the longitudinal central axis C of the elongated tubular body 120 in which the second force is applied. In this way, as seen from the perspective of the user, the wheel 141 can be slanted or skewed to the left when the user applies the second force to the left. In a similar way, as seen from the perspective of the user, the wheel 141 can be slanted or skewed to the right when the user applies the second force to the right.

[0044] In accordance with another exemplary embodiment of the cane 100, the elongated tubular body 120 is configured to move the wheel 141 from the first position to the second position in a direction that is opposite to the direction transverse to the longitudinal central axis C of the elongated tubular body 120 in which the second force is applied. In this way, as seen from the perspective of the user, the wheel 141 can be slanted or skewed to the left when the user applies the second force to the right. In a similar way, as seen from the perspective of the user, the wheel 141 can be slanted or skewed to the right when the user applies the second force to the left.

[0045] The person skilled in the art will appreciate that the use of the cane 100 according to the invention is less stressful and tiring for the user than the use of known canes. Therefore, the cane 100 according to the invention reduces at least the risk of injuries to at least one of the user's wrist and the muscles of at least one of the user's hand, arm and shoulder. In addition, it has been found that over-development of the muscles of at least one of the user's hand, arm and shoulder can be prevented by using the cane according to the present invention.

[0046] The wheel 141 of the cane 100 according to the invention may comprise a material that is selected from a group of materials including plastics, composite materials, ceramics or metals.

[0047] The person skilled in the art will appreciate that the tread of the wheel 141 of the cane 100 according to the invention must have a rounded shape like that of a wheel of a motor bike. Figure 1B shows that when the wheel 141 is in the first, neutral position, a first distance d1 between a first point 150 on a tread of the wheel 141 with which the wheel 141 is in contact with the surface 160 of the walkway and a shaft through the center 143 of the wheel 141 is largest. When the wheel 141 is in the second, slanted or skewed position, the distance d2 between a second point 151 on the tread of the wheel 141 with which the wheel 141 is in contact with the surface 160 of the walkway and a shaft through the center 143 of the wheel 141 is smaller than distance d1. Figure 1B shows the situation in which the wheel 141 is in the second, slanted or skewed position.

[0048] In accordance with the first exemplary, non-limiting embodiment of the cane 110 as shown in figure 1A, the tactile unit 140 includes a support structure 142 that is provided with a shaft that is arranged to pass through the center 143 of the wheel 141 to support the wheel 141. The tactile unit 140 furthermore comprises a position setting arrangement 144 that is configured to set an orientation of the wheel 141 with respect to the elongated tubular body 120 when the wheel 141 is in the first, neutral position. In this way the first, neutral position of the wheel 141 can be set in accordance with the user's personal preference. For example, the user can set the wheel 141 to be in a skewed position with respect to the elongated tubular body 120 when being in the first, neutral position. However, the user can also choose to align the wheel 141 with the elongated tubular body 120 when being in the first, neutral position. The latter situation is shown in figure 1A.

[0049] In accordance with the first exemplary, non-limiting embodiment of the biasing arrangement 130 shown in figure 1A, the biasing arrangement 130 includes a first unit 135 that is provided with a first magnet 131 and a second unit 136 that is provided with a second magnet 132. The first unit 135 and the first magnet 131 are arranged in the grip area 110, whereas the second unit 136 and the second magnet 132 are arranged in the first end part 121 of the elongated tubular body 120 of the cane 100. The person skilled in the art will appreciate that any suitable number of magnets can be applied.

[0050] When the wheel is in the first, neutral position as shown in figure 1A, i.e. when the first force that is applied by

the user to the grip area 110 in a direction transverse to the longitudinal central axis C of the elongated tubular body 120 is smaller than the predefined threshold or in the event that no force in a direction transverse to the longitudinal central axis C of the elongated tubular body 120 is applied to the grip area 110, the first magnet 131 and the second magnet 132 try to restore or maintain the arrangement in which their respective opposing poles, i.e. the north pole of the first magnet 131 or the north pole of the second magnet 132 and the south pole of the first magnet 131 or the south pole of the second magnet 132, face each other, i.e. are aligned with respect to each other. In this case, the cane 100 can be moved in a forward direction only.

[0051] In the event that the second force in a direction transverse to the longitudinal central axis C of the elongated tubular body 120 is applied by the user to the grip area 110, wherein the second force is at or above the predefined threshold, the respective opposing poles of the first magnet 131 and the second magnet 132, i.e. the north pole of the first magnet 131 or the north pole of the second magnet 132 and the south pole of the first magnet 131 or the south pole of the second magnet 132 are brought into misalignment with respect to each other as a result of the fact that they are moved away from each other. As long as the second force is at or above the predefined threshold, the respective opposing poles of the first magnet 131 and the second magnet 132 stay misaligned with respect to each other. In this case, the cane 100 can be swung, i.e. moved sideways either when standing still or when walking because the wheel 141 is slanted or skewed as is shown at the right hand side of figure 1B.

[0052] In the first exemplary, non-limiting embodiment of the biasing arrangement 130 the first magnet 131 and the second magnet 132 are ring magnets. The person skilled in the art will appreciate that any suitable kind of magnets and any suitable combination of suitable kinds of magnets can be used, for example a combination of at least one ring magnet and at least one bar magnet as will be discussed in relation to figure 2.

[0053] The respective axial center lines of the first magnet 131 and of the second magnet 132 shown in figures 1A and 1C, the latter providing a schematic cross-sectional view of the first exemplary, non-limiting embodiment of the cane 100 from a different viewing angle, are parallel to the longitudinal central axis C of the elongated tubular body 120. Furthermore, the first magnet 131 and the second magnet 132 have a flat circular shape wherein the thickness of the magnets as seen along the longitudinal y-axis shown in figure 1A does not exceed the diameter of the magnets as seen along the lateral x-as shown in figure 1A. The first magnet 131 and the second magnet 132 may be provided with a hole that is arranged in their respective centers. The hole of the first magnet 131 and of the second magnet 132 may be adapted to receive a rotating shaft. The rotating shaft enables rotational movement of the grip area 110 and the elongated tubular body 120 with respect to each other.

[0054] As shown in figures 1A and 1C, the grip area 110 and the first end part 121 are connected to each other with bearing elements 133, 134 that are arranged in the second unit 136 of the biasing arrangement 130. The bearing elements 133, 134 may be selected from a group that includes ball bearings, hydrostatic bearings, ring bearings, linear bearings, or rolling element bearings. The bearing elements 133, 134 can be configured and arranged to carry the force that is applied by the user by placing rolling elements such as balls or rollers between two bearing rings called races. The relative motion of the races may cause the rolling elements of the bearing elements 133, 134 to roll with very little rolling resistance and with little sliding.

[0055] Furthermore, as shown in figures 1A and 1C, the first magnet 131 and the second magnet 132 are separated by a first air gap 170. The first unit 135 and the second unit 136 of the biasing arrangement 130 are separated by a second air gap 171 to allow the first unit 135 and the second unit 136 to freely rotate with respect to each other.

[0056] Figure 2 shows a schematic cross-sectional view of a second exemplary, non-limiting embodiment of the biasing arrangement 130 of a cane 100 according to the invention. The first magnet 131 is a bar magnet and the second magnet 132 is a ring magnet. The first magnet 131 is threaded to allow the first magnet 131 and the second magnet 132 to be movable with respect to each other. In this way, the first air gap 170 between the first magnet 131 and the second magnet 132 can be changed, i.e. increased or decreased, in order to adjust the magnetic force that determines the predefined threshold that must be overcome by the second force that is applied by the user to the grip area in the direction transverse to the longitudinal central axis C of the elongated tubular body 120 in order to change the position of the wheel 141 from the first, neutral position to the second, skewed or slanted position.

[0057] Figure 3A shows a schematic cross-sectional view of a third exemplary, non-limiting embodiment of the biasing arrangement 130 of a cane 100 according to the invention. The biasing arrangement 130 includes a spring mechanism 138 that comprises a spring 138a and an axel 133a that moves in a slot 139 that is provided in the first end part 121 of the elongated tubular body 120. The spring 138a has a first end that is associated with the axel 133a and a second end that is attached to the first end part 121 of the elongated tubular body 120. In this way, the spring mechanism 138 can be used instead of using magnets to implement the biasing arrangement 130 of the cane 100 according to the invention. Furthermore, the biasing arrangement 130 shown in figure 3A comprises a guiding axle 137 that is surrounded by the spring 138a. The guiding axle 137 passes through the axel 133a via a guideway provided therein. As mentioned above, the grip area 110 and the first end part 121 of the elongated tubular body 120 can be rotatably connected with respect to each other around the longitudinal central axis C of the elongated tubular body 120. The rotational connection between the grip area 110 and the elongated tubular body 120 may be ensured with the rotating shaft 180 that passes through

the spring 138a.

[0058] In the event that the user desires to change his direction, the second force that is to be applied to the grip area 110 in a direction transverse to the longitudinal axis C of the elongated tubular body 120 is at or above the predefined threshold. In that case, the axel 133a slides in the slot 139 and thereby compresses the spring 138a. As a result, the spring 138a is loaded with energy upon changing the position of the wheel 141 from the first, neutral position to the second, slanted or skewed position.

[0059] When the first force that is applied to the grip area 110 in a direction transverse to the longitudinal axis C of the elongated tubular body 120 is smaller than the predefined threshold or in the event that no force in a direction transverse to the longitudinal central axis C of the elongated tubular body 120 is applied to the grip area 110, the spring 138a slides back through the slot 139 thereby releasing the energy loaded in the spring 138a. As a result of the energy released by the spring 138, the biasing arrangement 130 allows moving the wheel back from the second, slanted or skewed position to the first, neutral position.

The person skilled in the art will appreciate that the slot 139 may have any suitable shape that allows the axel 133a to move in response to the force that is applied to the grip area 110 in a direction transverse to the longitudinal axis of the elongated tubular body. The shape of the slot 139 is not limited to the shape shown in figures 3A and 3B. The slot 139 may for example have a triangular shape, a bow shape, a concave shape, a convex shape, a falcate shape, a semicircular shape, or a curved shape.

[0060] Depending on the direction, i.e. left or right, in which a force is applied to the grip area 110 in a direction transverse to the longitudinal axis C, the axel 133a may slide in one of the half parts of the slot 139 on either side of the longitudinal central axis C.

[0061] In another exemplary embodiment of the biasing arrangement, the spring mechanism may be coupled to magnets, for example the first magnet 131 and the second magnet 132 as shown in figures 1A-1C, which are arranged with respect to each other such that their respective opposing poles face each other, i.e. are aligned with respect to each other. In this way, a hybrid biasing mechanism may be obtained that has improved tuning possibilities for adjusting the abovementioned threshold to the individual requirements of the user.

[0062] Figure 3B shows a schematic detailed view of a fourth exemplary, non-limiting embodiment of the biasing arrangement 130 of a cane 100 according to the invention. The part of the cane that is shown in figure 3B comprises the grip area that includes the fourth exemplary, non-limiting embodiment of the biasing arrangement 130 and the guiding axle 137 that is associated with the handle 111 that is only partly shown in figure 4.

[0063] In accordance with the fourth exemplary, non-limiting embodiment of the biasing arrangement 130 shown in figure 3B, a threaded portion 190 is provided that is arranged to be associated with the handle 111. By appropriately rotating the handle 111, the threaded portion 190 can be displaced in any desired way to allow adjusting the degree to which the spring 138a is biased. Consequently, it is possible to adjust the spring force that determines the predefined threshold that must be overcome by the second force that is applied by the user to the grip area 110 in the direction transverse to the longitudinal central axis C of the elongated tubular body 120 in order to change the position of the wheel 141 from the first, neutral position to the second, skewed or slanted position. The person skilled in the art will appreciate that in accordance with the third exemplary, non-limiting embodiment of the biasing arrangement 130 shown in figure 3A, the spring force cannot be adjusted by manipulating the handle 111.In another exemplary embodiment of the biasing arrangement, the spring mechanism may be coupled to magnets that are arranged with respect to each other such that their respective opposing poles face each other, i.e. are aligned with respect to each other. The person skilled in the art will appreciate that any suitable number of magnets can be applied. In this way, a hybrid biasing mechanism may be obtained that has improved tuning possibilities for adjusting the abovementioned threshold to the individual requirements of the user.

[0064] Figure 4A shows a schematic view of a second exemplary, non-limiting embodiment of a cane 100 according to the invention comprising an elongated tubular body 120 having a first end part 121, a second end part 122 and a longitudinal central axis C. The first end part 121 is provided with a grip area 110 that includes a handle 111 that is rotatably associated with the first end part 121 of the elongated tubular body 120 via a fixation mechanism 112. The fixation mechanism 112 can be any suitable element that enables releasably fixing the handle 111 in any desired position with respect to the elongated tubular body 120. The fixation element 112 can for example comprise a threaded portion, a bolt, a nut, a washer, a screw, a rod, a lever, an insert, a ball joint, an axle or any suitable combination of the afore-mentioned exemplary components.

[0065] In accordance with the exemplary embodiment of the fixation element 112 shown in figures 4A and 4B, the fixation mechanism 112 comprises an axle 112a that is adapted to allow rotation of the handle 111 around the axle 112a to arrange the handle 111 in an operational position that allows the user to hold the handle 111 in his or her hand while being allowed to keep that hand in its neutral or so-called Neanderthal position when using the cane according to the invention. The neutral or Neanderthal position of the hand is favorable as in this position of the hand stressing of the wrist and the muscles of at least one of the hand, arm and shoulder can be reduced further. In this way, at least the risk of injuries to at least one of the wrist and the muscles of at least one of the hand, arm and shoulder can be reduced

further. In addition, it has been found that over-development of the muscles of at least one of the user's hand and arm can be reduced further.

[0066] In the exemplary embodiment of the cane 100 with the handle 111 in the operational position as shown in figure 4A, the first angle α between the longitudinal central axis 201 of the handle 111 and the longitudinal central axis C of the elongated tubular body 120 is equal to 30°. However, the person skilled in the art will appreciate that depending on the user's physique any suitable value in the first range between 30° and 60° can be chosen.

[0067] Figure 4B shows a schematic top view of the second exemplary, non-limiting embodiment of the cane 100 shown in figure 4A. As seen along the longitudinal central axis C of the elongated tubular body 120 a central plane 200 of the wheel 141 is oriented parallel to the longitudinal central axis C and perpendicular to an axial central axis 202 of the wheel 141. A second angle β is present between the longitudinal central axis 201 of the handle 111 and the aforementioned central plane 200 of the wheel 141. Just as an example, the second angle β in figure 4B is equal to 45°. However, the person skilled in the art will appreciate that depending on the user's physique any suitable value in the second range between 10° and 45° can be chosen.

[0068] The person skilled in the art will appreciate that the fixation mechanism 112 can also establish a releasable fixation of the handle 111 when at least one of the first angle α and the second angle β are not within at least one of the first range and the second range. However, in such event the abovementioned advantages related to the operational position of the handle are less.

[0069] Furthermore, the person skilled in the art will appreciate that the operational position of the handle can be set for left-handed users and for right-handed users in a similar way.

[0070] Returning to figure 4A, the second exemplary, non-limiting embodiment of the cane 100 comprises a tactile unit 140 that is associated with the second end part 122 of the tubular body 120. The tactile unit 140 comprises a wheel 141. In use of the cane 100, the wheel 141 is positioned on a surface 160 of a walkway and is configured to provide the user with information that is indicative for a walkability of the walkway.

[0071] Although not explicitly shown in figure 4A, the cane 100 also comprises a biasing arrangement like the cane 100 shown for example in figure 1A. Hence, the wheel 141 of the cane 100 shown in figure 4A can be positioned in the first, neutral position and in the second, slanted or skewed position in a same way as described above.

[0072] The present invention can be summarized as relating to a cane 100 configured to assist a visually impaired user when traveling on foot, the cane comprising an elongated tubular body 120 having a first end part 121 and a second end part 122, a grip area 110 associated with the first end part and a tactile unit 140 associated with the second end part. The tactile unit comprises a wheel 141 and a biasing arrangement 130 configured to enable the wheel to stay in a first position, when a first force applied by the user to the grip area in a direction transverse to a longitudinal central axis C of the elongated tubular body is smaller than a predefined threshold, and to enable the wheel to assume a second position that is different from the first position when a second force that is applied to the grip area in the direction transverse to the longitudinal central axis is at or above the predefined threshold.

[0073] It will be clear to a person skilled in the art that the scope of the present invention is not limited to the examples discussed in the foregoing but that several amendments and modifications thereof are possible without deviating from the scope of the present invention as defined by the attached claims. In particular, combinations of specific features of various aspects of the invention may be made. An aspect of the invention may be further advantageously enhanced by adding a feature that was described in relation to another aspect of the invention. While the present invention has been illustrated and described in detail in the figures and the description, such illustration and description are to be considered illustrative or exemplary only, and not restrictive.

[0074] The present invention is not limited to the disclosed embodiments. Variations to the disclosed embodiments can be understood and effected by a person skilled in the art in practicing the claimed invention, from a study of the figures, the description and the attached claims. In the claims, the word "comprising" does not exclude other steps or elements, and the indefinite article "a" or "an" does not exclude a plurality. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. Any reference numerals in the claims should not be construed as limiting the scope of the present invention.

REFERENCE NUMERALS

100	Cane
110	Grip area
111	Handle
112	Fixation mechanism
112a	Axle of the fixation mechanism
120	Elongated tubular body

(continued)

121	First end part of the elongated tubular body
122	Second end part of the elongated tubular body
130	Biasing arrangement
131	First magnet
132	Second magnet
135	First unit of the biasing arrangement
136	Second unit of the biasing arrangement
133, 134	Bearing elements
133a	Axel
137	Guiding axle
138	Spring mechanism
138a	Spring
139	Slot
140	Tactile unit
141	Wheel
142	Support element
143	Center of the wheel
144	Position setting arrangement
150	First point on the tread of the wheel
151	Second point on the tread of the wheel
160	Surface of the walkway
170	First air gap between the first magnet and the second magnet
171	Second air gap between the first unit and the second unit of the biasing arrangement
180	Rotating shaft
190	Threaded portion
200	Central plane of the wheel
201	Longitudinal central axis of the handle
202	Axial central axis of the wheel
C	Longitudinal central axis of the elongated tubular body
d1	Distance between the first point on the tread of the wheel with which the wheel is in contact with the surface of the walkway and a shaft through the center of the wheel
d2	Distance between the second point on the tread of the wheel with which the wheel is in contact with the surface of the walkway and a shaft through the center of the wheel
X	Lateral axis
Y	Longitudinal axis
α	First angle
β	Second angle

Claims

1. A cane (100) configured to assist a visually impaired user when traveling on foot, the cane (100) comprising:

   - an elongated tubular body (120) having a first end part (121) and a second end part (122);
   - a grip area (110) that is associated with the first end part (121) of the elongated tubular body (120) and is configured to be held by said user within at least one of his hands when using the cane;
   - a tactile unit (140) that is associated with the second end part (122) of the elongated tubular body (120), the tactile unit (140) comprising a wheel (141) that in use of the cane is positioned on a surface (160) of a walkway and is configured to provide information to said user, wherein the information is indicative for a walkability of the walkway, wherein the wheel (141) is in a first position when a first distance (d1) between a first point (150) on a tread of the wheel (141) with which the wheel (141) is in contact with the surface (160) of the walkway and the center (143) of the wheel (141) is largest; and
   - a biasing arrangement (130) that is configured to enable the wheel (141) to assume the first position when a first force that is applied by said user to the grip area (110) in a direction transverse to a longitudinal central axis (C) of the elongated tubular body (120) is smaller than a predefined threshold, and wherein the biasing arrangement (130) is configured to enable the wheel (141) to assume a second position that is different from the first position when a second force that is applied by said user to the grip area (110) in the direction transverse to the longitudinal central axis (C) of the elongated tubular body (120) is at or above the predefined threshold.

2. The cane (100) according to claim 1, wherein the grip area (110) and the first end part (121) of the elongated tubular body (120) are connected with respect to each other such that they are rotatable with respect to each other around the longitudinal central axis (C) of the elongated tubular body.

3. The cane (100) according to claim 1 or 2, wherein the grip area (110) comprises a first unit (135) of the biasing arrangement (130) and the first end part (121) of the elongated tubular body (120) comprises a second unit (136) of the biasing arrangement (130), the first unit (135) of the biasing arrangement (130) comprising a first magnet (131) and the second unit (136) of the biasing arrangement (130) comprising a second magnet (132), wherein when the wheel (141) is in the first position the respective opposing poles of the first magnet (131) and the second magnet (132) face each other.

4. The cane (100) according to claim 3, wherein the first magnet (131) and the second magnet (132) are arranged to be movable with respect to each other.

5. The cane (100) according to claim 1, wherein the biasing arrangement (130) comprises a spring mechanism (138) that is configured to allow the wheel (141) to be movable from the first position to the second position in response to the second force and to be movable from the second position to the first position in response to application of the first force.

6. The cane (100) according to claim 5, wherein the spring mechanism (138) comprises a spring (138a) that is in a compressed state when the wheel (141) is in the second position.

7. The cane (100) according to claim 6, wherein the spring (138a) is in a released state when the wheel (141) is in the first position.

8. The cane (100) according to claims 3 and 5, wherein the spring mechanism (138) is associated with the first magnet (131) and the second magnet (132).

9. The cane (100) according to claim 1, wherein the grip area (110) is provided with a slot (139) that is arranged to cooperate with the first end part (121) of the elongated tubular body (120).

10. The cane (100) according to claims 5 and 9, wherein the spring mechanism (138) further comprises an axel (133a) that is adapted to move in the slot (139) in response to the application of the first force or application of the second force.

11. The cane (100) according to claim 1, wherein the elongated tubular body (120) is configured to move the wheel (141) from the first position to the second position in a same direction as the direction transverse to the longitudinal central axis (C) of the elongated tubular body (120) in which the second force is applied.

12. The cane (100) according to claim 1, wherein the elongated tubular body (120) is configured to move the wheel (141) from the first position to the second position in a direction that is opposite to the direction transverse to the longitudinal central axis (C) of the elongated tubular body (120) in which the second force is applied.

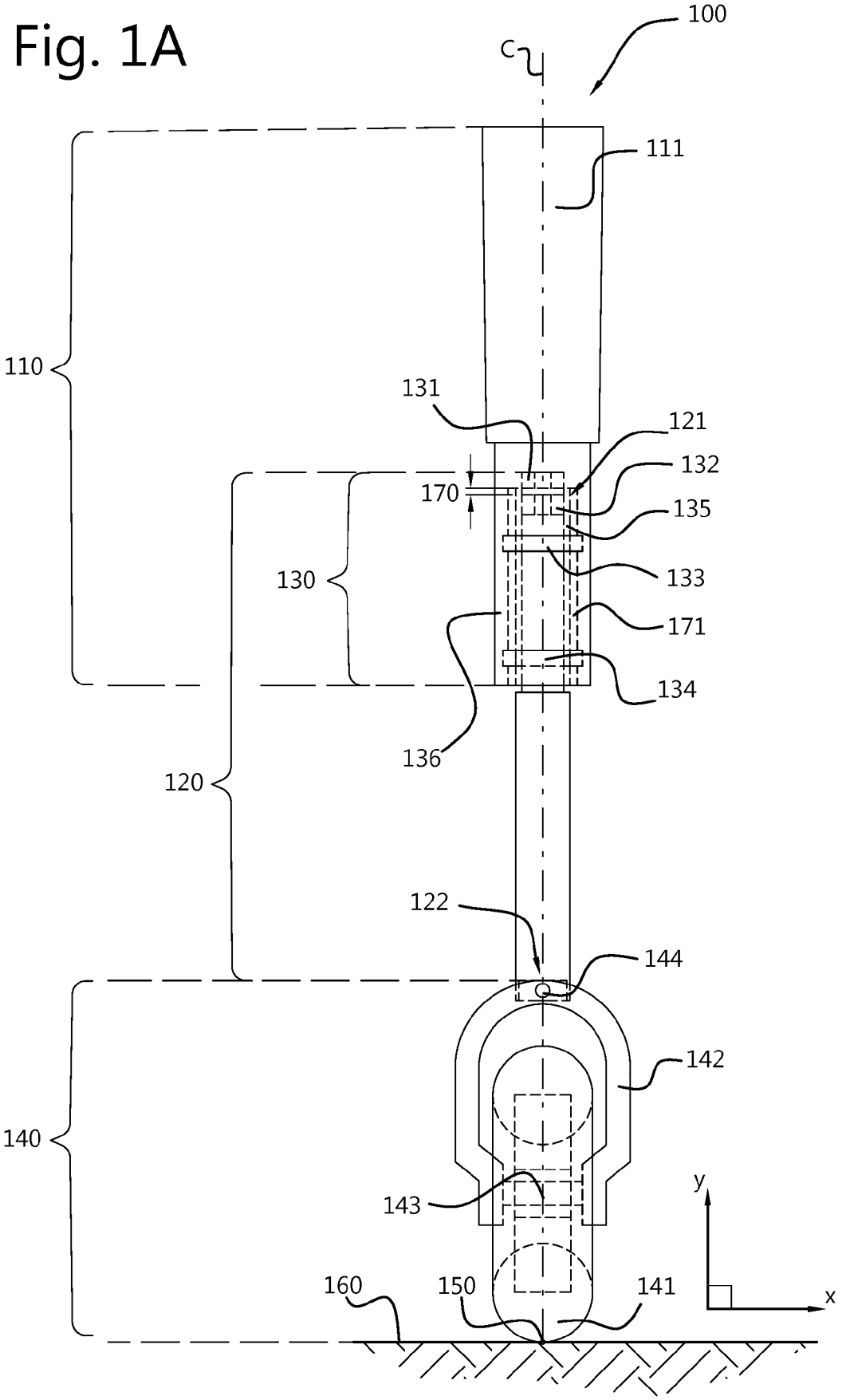
13. The cane (100) according to claim 1, wherein the grip area (110) further comprises a handle (111) that is associated with the elongated tubular body (120) via a fixation mechanism (112).

14. The cane (100) according to claim 13, wherein the fixation mechanism (112) is adapted to allow a releasable fixation of the handle (111) at least when the handle (111) is in an operational position with respect to the elongated tubular body (120), the handle (111) being in the operational position when:

- a first angle (α) is present between a longitudinal central axis (201) of the handle (111) and the longitudinal central axis (C) of the elongated tubular body (120), the first angle (α) being in a first range between 30° and 60°, preferably being equal to 45°; and
- a second angle (β) is present between the longitudinal central axis (201) of the handle (111) and a central plane (200) of the wheel (141) as seen along the longitudinal central axis (C), the central plane of the wheel (141) being oriented parallel to the longitudinal central axis (C) of the elongated tubular body (120) and perpendicular to an axial central axis (202) of the wheel (141), the second angle (β) being in a second range between 10° and 45°, preferably being equal to 30°.

15. The cane (100) according to anyone of the preceding claims, wherein the biasing arrangement (130) further comprises at least one bearing element (133, 134) that is configured to convert the second force that is applied by said user to the grip area (110) in the direction transverse to the longitudinal central axis (C) of the elongated tubular body (120) into a rotational force that enables the wheel (141) to be rotatable around the longitudinal central axis (C) of the elongated tubular body (120) to assume the second position.

Fig. 1A


100
C
111
110
131
121
132
170
135
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133
171
134
136
120
122
144
142
140
143
y
x
160
150
141

Fig. 1B

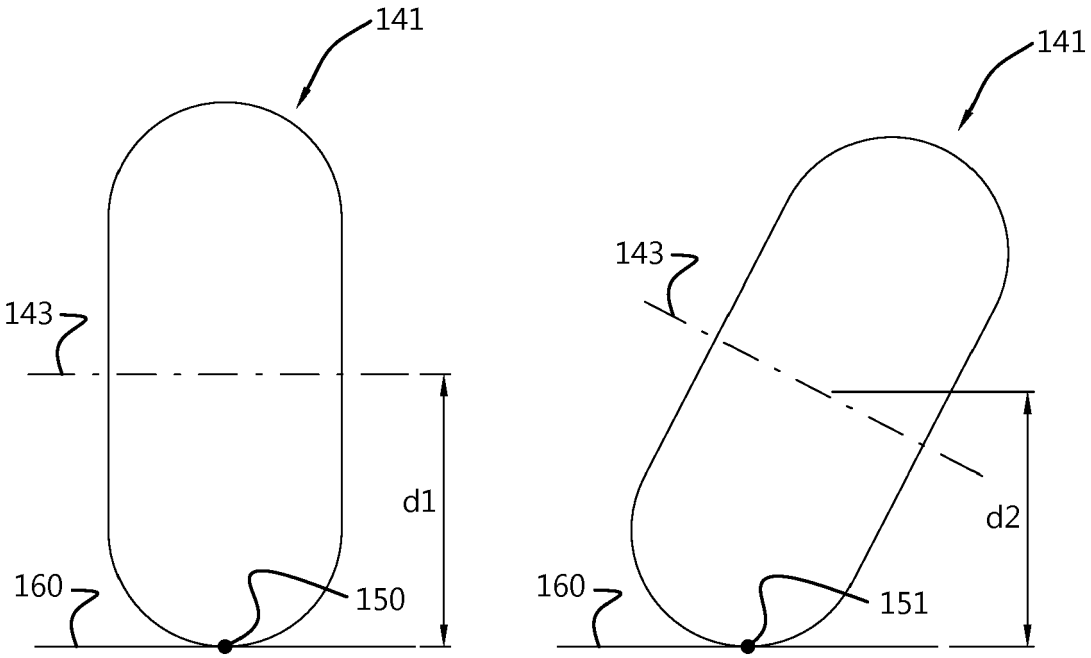

Fig. 1C

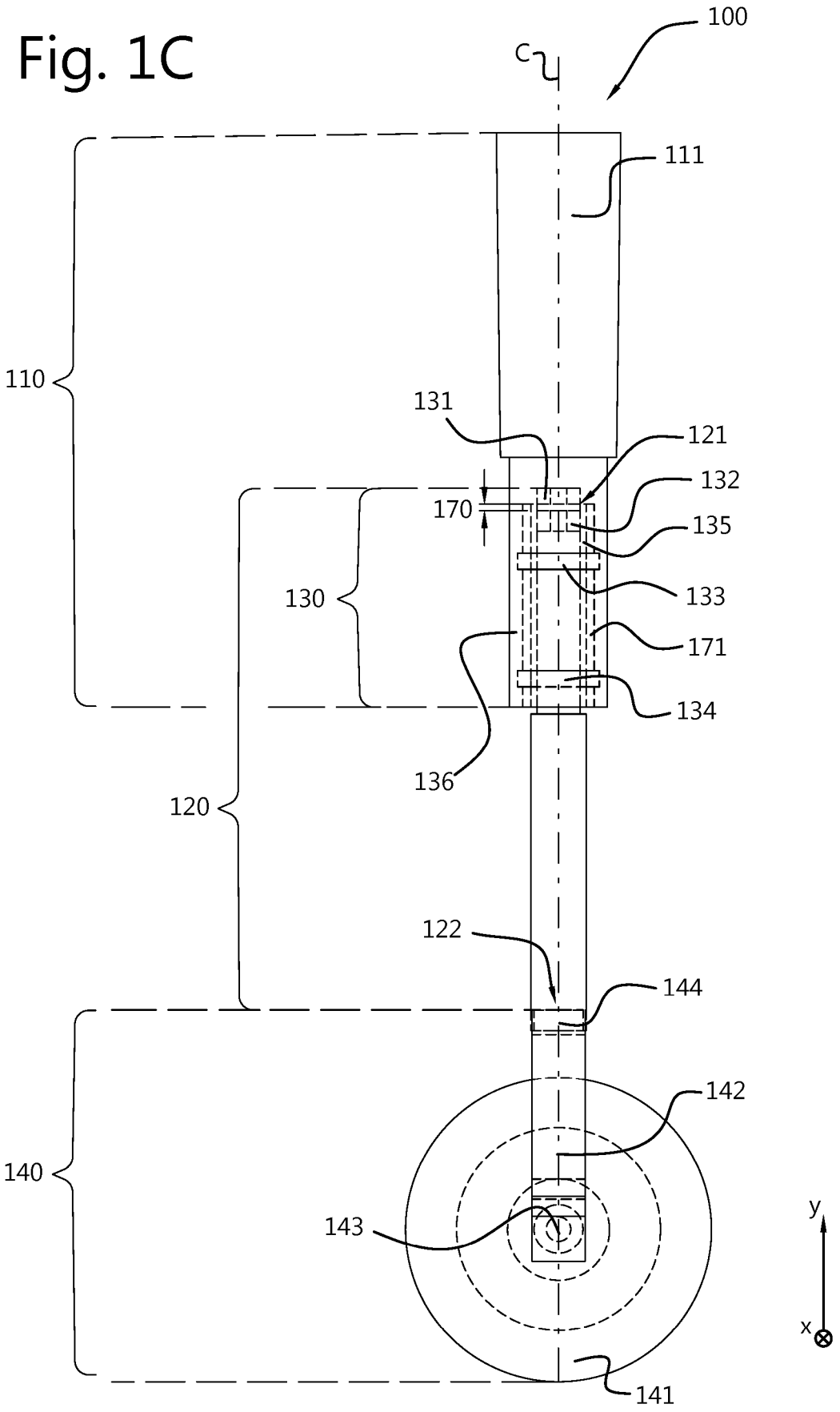
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Fig. 2

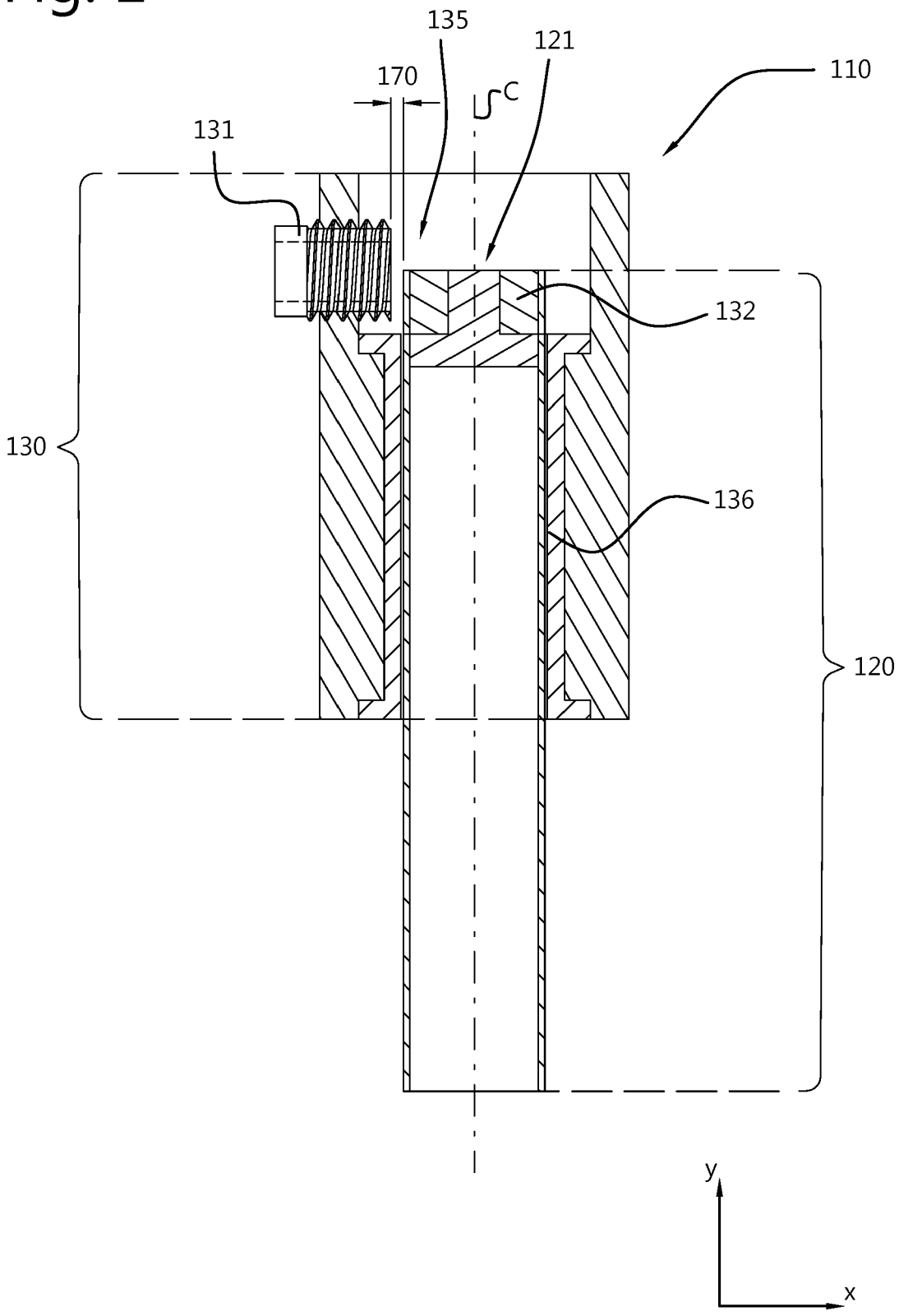

Fig. 3A

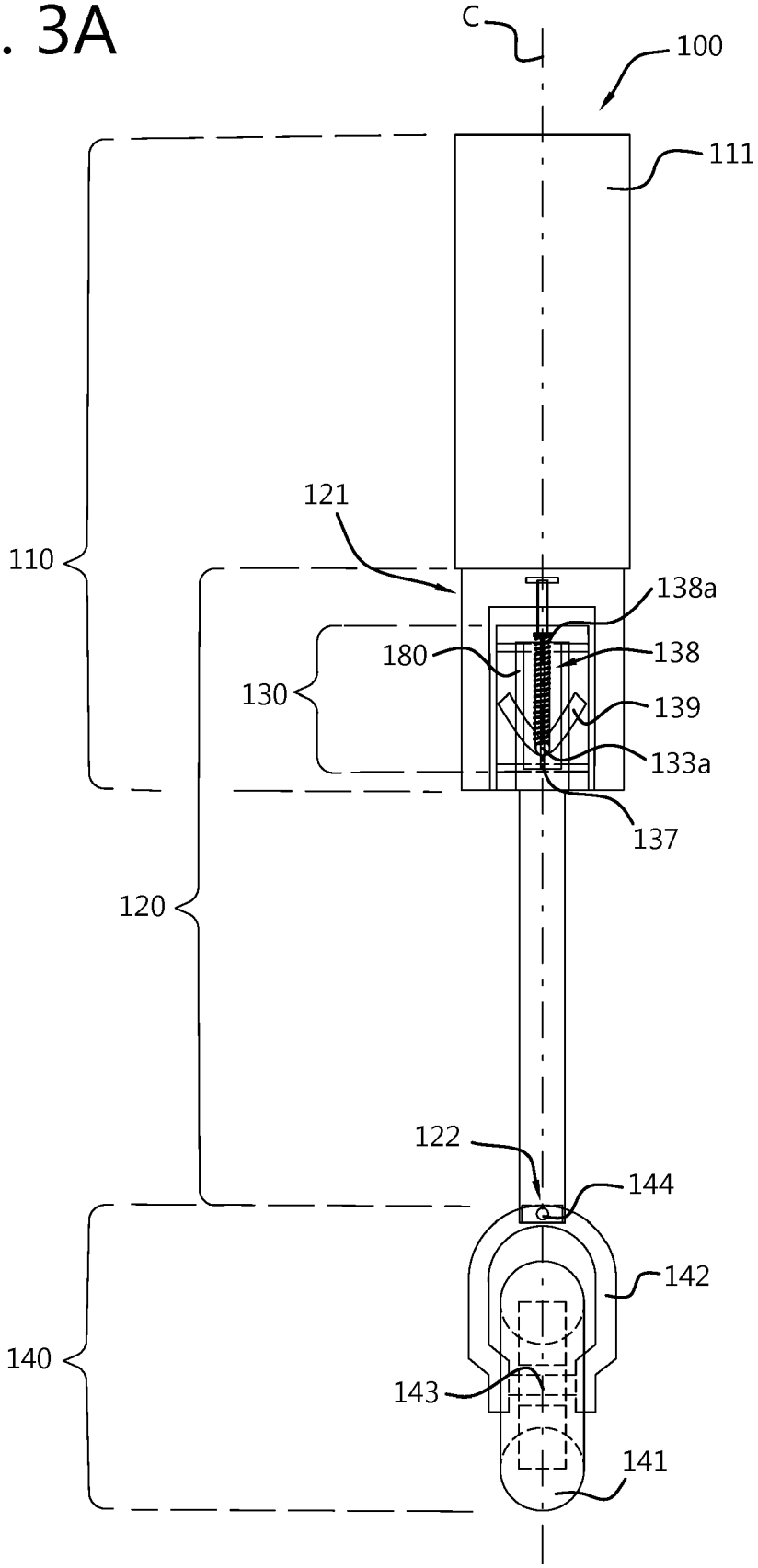
C
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Fig. 3B

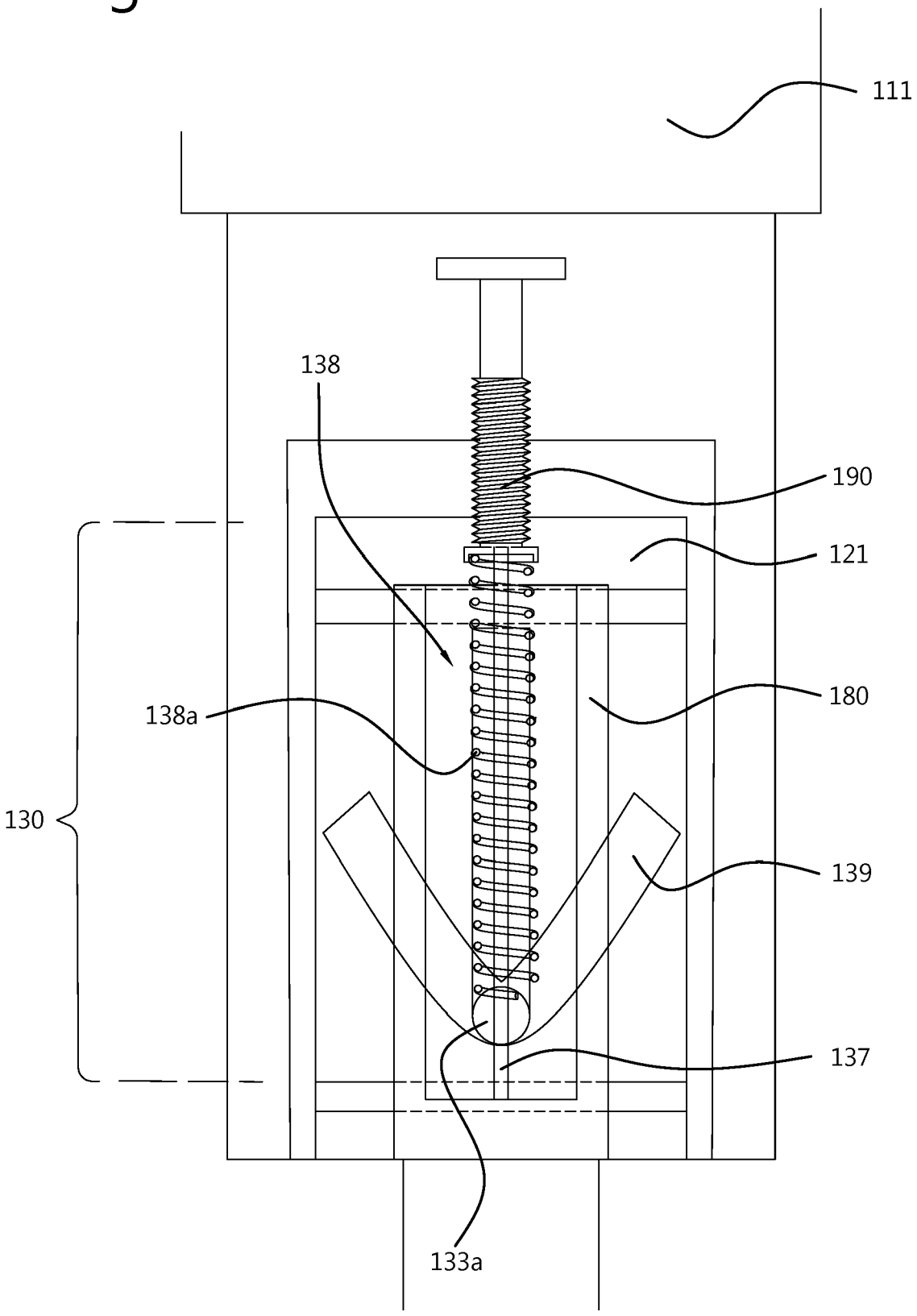

Fig. 4A

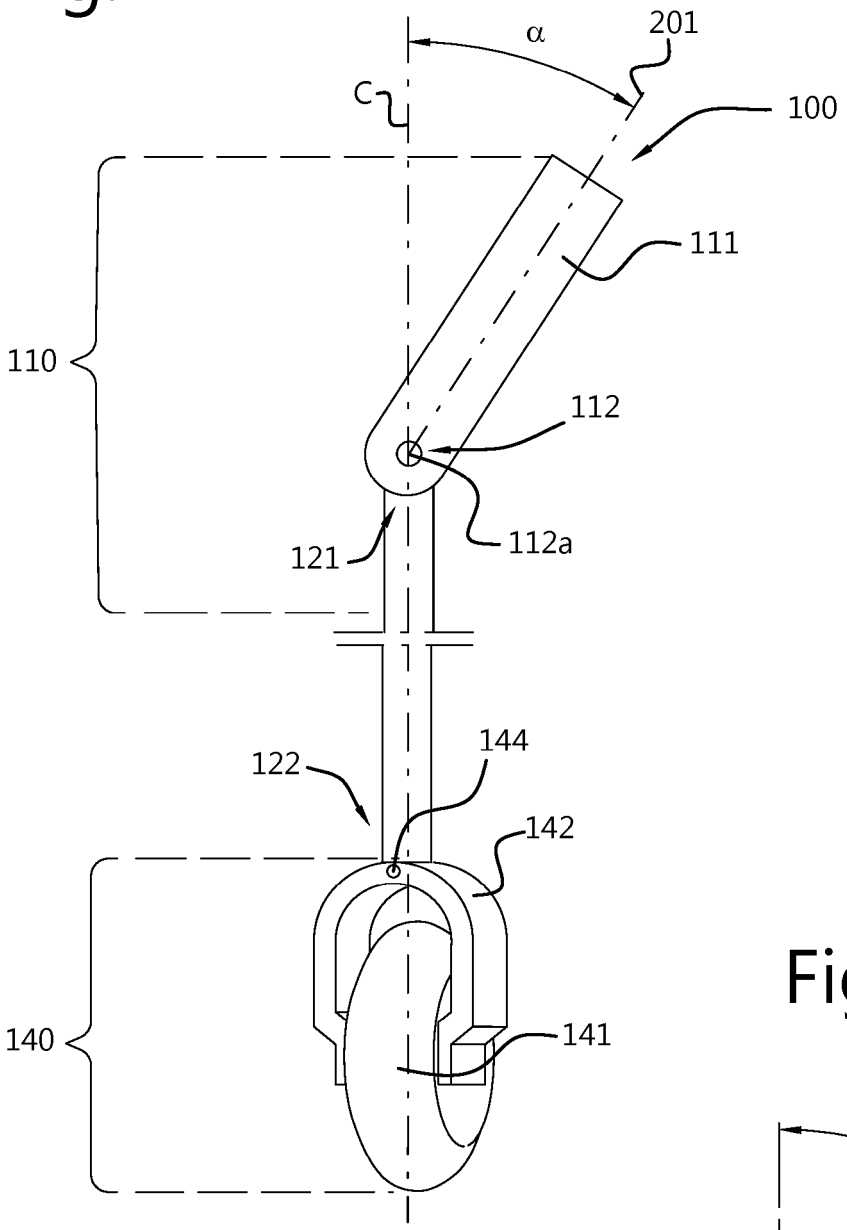
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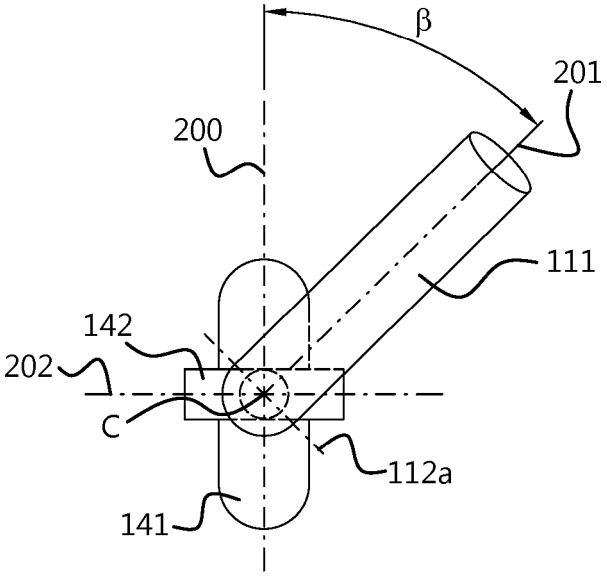
Fig. 4B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C
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EUROPEAN SEARCH REPORT

Application Number
EP 19 19 4603

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

A61H
A45B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	6 February 2020	Fischer, Elmar

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06-02-2020

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