



(12)

EUROPEAN PATENT APPLICATION

- (43)

Date of publication:
10.07.2024 Bulletin 2024/28
- (51)

International Patent Classification (IPC):
A47L 5/30 (2006.01) A47L 9/04 (2006.01)
- (21)

Application number: 23161255.7
- (52)

Cooperative Patent Classification (CPC):
A47L 5/30; A47L 9/0411; A47L 9/0455;
A47L 9/0477
- (22)

Date of filing: 10.03.2023

(84) Designated Contracting States: AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR Designated Extension States: BA Designated Validation States: KH MA MD TN (30) Priority: 06.01.2023 CN 202310036132 (71) Applicant: Versuni Holding B.V. 5656 AE Eindhoven (NL)	(72) Inventors: - GE, Chuang 5656 AE Eindhoven (NL) - WANG, Haixin 5656 AE Eindhoven (NL) (74) Representative: Vollering, Stefanus Franciscus Maria Versuni Holding B.V. High Tech Campus 42 5656 AE Eindhoven (NL)
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ROLLER BRUSH DEVICE AND SURFACE CLEANING APPARATUS

(57) The present disclosure relates to a roller brush device of a surface cleaning apparatus. The roller brush device (100) comprises: a base (120); a roller brush assembly (110) detachably mounted to the base (120) and comprising a roller brush shaft (112) that is configured to rotate about an axis of the roller brush; and a release device (130) comprising a release operation member mounted on the roller brush assembly (110) and configured to be actuated to release the locking between the base (120) and the roller brush assembly (110), and provide an assisting force for removing the roller brush assembly (110) duration the actuation. In this way, the user may conveniently remove roller brush assembly with a very small force.

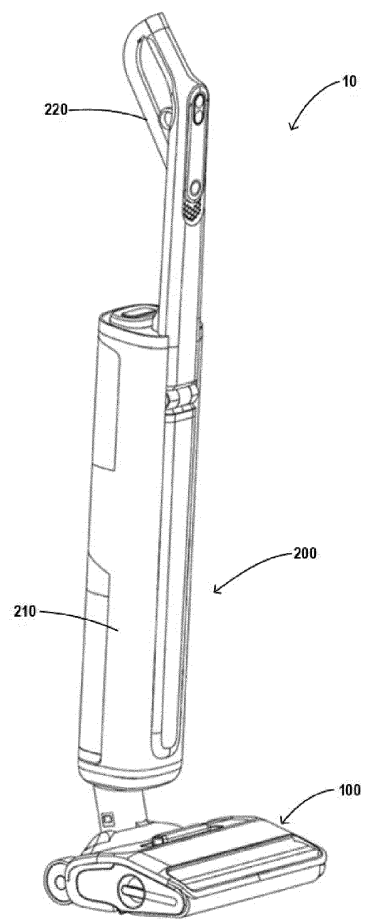


FIG. 1

Description

FIELD

[0001] Embodiments of the present disclosure generally relate to a surface cleaning apparatus, and more specifically to a roller brush device of a surface cleaning apparatus.

BACKGROUND

[0002] Surface cleaning apparatus, such as a floor cleaning machine or a cleaner robot, are widely used in daily life due to their excellent cleaning performance. The surface cleaning apparatus is usually provided with a roller brush that comes into contact with the surface to be cleaned. The dirt is picked up by the rotating roller brush to achieve surface cleaning. The coverage of the roller brush in the direction of rotation is crucial for cleaning ability of the roller brush. In order to achieve a maximum coverage of the roller brush, a cleaning element of the roller brush usually is designed to extend in an axial direction of the whole roller brush so that the roller brush can achieve cleaning in an entire region including edges. The roller brush is usually detachably disposed on a base of the roller brush, so that the roller brush can be periodically removed for maintenance during use, for example to remove dirt such as accumulated fibers. The conventional roller brush is subject to a problem of difficulty for removal, and there is a demand for further improvement of the surface cleaning apparatus.

SUMMARY

[0003] Embodiments of the present disclosure provide a roller brush device of a surface cleaning apparatus, intended to solve one or more of the above problems and other potential problems.

[0004] According to a first aspect of the present disclosure, there is provided a roller brush device. The roller brush device comprises: a base; a roller brush assembly detachably mounted to the base and comprising a roller brush shaft that is configured to rotate about an axis of the roller brush; and a release device comprising a release operation member mounted on the roller brush assembly and configured to be actuated to release a locking between the base and the roller brush assembly, and to provide an assisting force for removing the roller brush assembly during the actuation. In this way, through the release device, the locking between the roller brush and the base can be released, and meanwhile an assisting force for removing the roller brush assembly may also be provided, thereby making the removal labor-saving.

[0005] In some embodiments, the release operation member is a knob, and the release device further comprises an assisting device driven by the knob. In some embodiments, the assisting device comprises a push rod mounted in the roller brush shaft and extending along

the axis of the roller brush. The push rod is configured to be driven to move along the axis of the roller brush away from the knob during rotation of the knob to abut against the base. In this way, the locking between the roller brush and the base may be released conveniently through the rotation of the knob, and meanwhile an assisting force for removing the roller brush assembly may also be provided through the rotation of the knob.

[0006] In some embodiments, the roller brush shaft may include a through hole extending along the axis of the roller brush and configured to receive the push rod, and the push rod and the roller brush shaft coaxially extend. In this way, the push rod may be arranged in a structurally compact manner.

[0007] In some embodiments, the push rod may be configured to abut against a power shaft of the base, and the power shaft engages the roller brush shaft via a spline to transmit power from the power shaft to the roller brush shaft. As such, the push rod may counteract a static friction force between the roller brush shaft and the power shaft.

[0008] In some embodiment, the release device may further comprise a return spring for returning the push rod after the roller brush assembly is removed.

[0009] In some embodiments, the knob may include an operating portion disposed on the user side and a driving portion located on a side opposite to the operating portion, and the driving portion is configured to push the push rod to move during the rotation of the knob. In this way, the push rod may be conveniently driven through the driving portion.

[0010] In some embodiments, the driving portion comprises a protrusion protruding from the knob on a side opposite to the operating portion, and the protrusion is arranged eccentrically with respect to a center of rotation of the knob. Therefore, the driving portion may be implemented in a simple manner.

[0011] In some embodiments, the push rod may comprise an engaging portion adapted to engage with the driving portion. The engaging portion comprises a slope, a guide rail or a guide groove. The push rod may be conveniently moved and/or the movement of the push rod may be guided through the engaging portion.

[0012] In some embodiments, the release device may further comprise a locking member driven by the operation release member, and the locking member is movably disposed relative to the base to slide between a locked position where the locking member engages the base and an unlocked position where the locking member disengages from the base. In this way, the locking and unlocking of the base and the roller brush assembly may be achieved by moving a slider.

[0013] In some embodiments, the knob may comprise a toggle portion protruding laterally from the knob, and during rotation of the knob, the toggle portion pushes the locking member to move from the locked position to the unlocked position. As such, the locking member is directly driven by the toggle portion to achieve unlocking or

locking.

[0014] In some embodiments, the knob may drive the locking member through a link, one end of the link is pivotally connected to the knob, and the other end of the link is pivotally connected to the locking member. In this way, the locking member is indirectly driven by the link to achieve unlocking or locking.

[0015] In some embodiments, a pivoting portion of the link and the locking member may comprise a pivot disposed on one of the link and the locking member and a waist-shaped hole disposed on the other of the link and locking member, and the waist-shaped hole allows the pivot to move linearly in the waist-shaped hole. As such, deadlock of the link in which the link cannot be moved may be prevented.

[0016] In some embodiments, a sliding direction of the locking member may be set a non-zero angle with respect to an extension direction of the link. In this way, deadlock of the link in which the link cannot be moved may be prevented.

[0017] In some embodiments, the roller brush device may comprise a return spring for returning the locking member from the unlocked position to the locked position. In this way, automatic return of the locking member may be achieved.

[0018] According to a second aspect of the present disclosure, there is provided a surface cleaning apparatus. The surface cleaning apparatus comprises: the roller brush device according to the first aspect; and a main body assembly configured to support the roller brush device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The above and other objectives, features, and advantages of example embodiments of the present disclosure will become more apparent from the following detailed description with reference to the accompanying drawings. In the figures, several embodiments of the present disclosure are shown in an exemplary but unrestrictive manner.

FIG. 1 shows an overall schematic view of a surface cleaning apparatus according to an embodiment of the present disclosure.

FIG. 2 shows a schematic structural view of a roller brush device according to an embodiment of the present disclosure.

FIG. 3 shows a cross-sectional view of the roller brush device along an axis of the roller brush according to an embodiment of the present disclosure, with an assisting device being separate from a base.

FIG. 4 shows a cross-sectional view of the roller brush device along an axis of the roller brush according to an embodiment of the present disclosure, with

the assisting device abutting against the base to provide removal assistance.

FIG. 5 shows a perspective cross-sectional view of a knob and a push rod according to an embodiment of the present disclosure.

FIG. 6 shows a side view of a roller brush device according to an embodiment of the present disclosure, with the roller brush device in a locked state.

FIG. 7 shows a side view of a roller brush device according to an embodiment of the present disclosure with the roller brush device in an unlocked state.

FIG. 8 shows a partial cross-sectional view of the roller brush device shown in FIG. 6, showing details of locking and unlocking operations of a locking member.

FIG. 9 shows a side view of a roller brush device according to another embodiment of an embodiment of the present disclosure, with the roller brush device in a locked state.

FIG. 10 shows a side view of a roller brush device according to a further embodiment of an embodiment of the present disclosure, with the roller brush device in a locked state.

FIG. 11 shows a partial cross-sectional view of the roller brush device shown in FIG. 10, showing details of locking and unlocking operations of a locking member.

[0020] In all figures, the same or corresponding reference numbers denote the same or corresponding parts.

DETAILED DESCRIPTION OF EMBODIMENTS

[0021] Preferred embodiments of the present disclosure will be described as follows in greater detail with reference to the drawings. Although preferred embodiments of the present disclosure are illustrated in the drawings, it is to be understood that the present disclosure described herein can be implemented in various manners, not limited to the embodiments illustrated herein. Rather, these embodiments are provided to make the present disclosure described herein clearer and more complete and convey the scope of the present disclosure described herein completely to those skilled in the art.

[0022] As used herein, the term "comprises" and its variants are to be read as open-ended terms that mean "comprises, but is not limited to." The term "or" is to be read as "and/or" unless the context clearly indicates otherwise. The term "based on" is to be read as "based at least in part on." The term "one example implementation" and "an example implementation" are to be read as "at

least one example implementation." The term "another implementation" is to be read as "at least one other implementation." The terms indicating placement or positional relationship such as "up", "down", "front" and "rear" are based on the orientation or positional relationship shown in the figures, and are only for the convenience in describing the principles of the present disclosure, rather than indicating or implying that the designated elements must have a particular orientation, be constructed or operated in a particular orientation, and thus should not be construed as limiting the present disclosure. A roller brush device and a surface cleaning apparatus according to the embodiments of the present disclosure will be described below with reference to the figures.

[0023] FIG. 1 shows an overall schematic view of a surface cleaning apparatus 10 according to an embodiment of the present disclosure. As shown in FIG. 1, the surface cleaning apparatus 10 comprises a roller brush device 100 and a main body assembly 200. The roller brush device 100 is used as a surface cleaning member. The roller brush device 100 comprises a roller brush that contacts a surface. When the roller brush is driven to rotate, the dirt may be picked up by the roller brush. The roller brush device 100 may be mounted to the main body assembly 200. The main body assembly 200 may include a collection device 210 for collecting dirt, a handle 220 adapted to be grasped by a user, and other parts. The roller brush device 100 may be in fluid communication with the collection device 210. FIG. 1 illustrates a structure of a handheld floor cleaning machine. It is to be understood that the roller brush device 100 of the present disclosure may also be applied to surface cleaning apparatuses such as a cleaner robot that can clean automatically. Here, the example in FIG. 1 is not intended to limit the present disclosure.

[0024] FIG. 2 shows a schematic structural view of a roller brush device 100 according to an embodiment of the present disclosure. FIG. 3 shows a cross-sectional view of the roller brush device along an axis of the roller brush according to an embodiment of the present disclosure. As shown in FIG. 2 and FIG. 3, the roller brush device 100 comprises a base 120 and a roller brush assembly 110. The base 120 is configured to support and drive the roller brush assembly 110. The base 120 may include a power driving device such as a motor for driving the roller brush assembly 110 to rotate. The roller brush assembly 110 may include a cleaning member 117 and a roller brush shaft 112 mounted inside the cleaning member 117 (see FIG. 3). The cleaning member 117 may be a mop or the like, and the cleaning member 117 for cleaning is fixed to the roller brush shaft 112 and rotates as the roller brush shaft 112 rotates, so as to realize surface cleaning.

[0025] The driving device of the base 120 comprises a power shaft 122 coupled with an output shaft of a motor. The power shaft 122 may include a spline. The power shaft 122 may be coupled with the roller brush shaft 112 by for example the spline. The roller brush shaft 112 may

be provided with a coupling 119 adapted to be coupled with the power shaft 122. The coupling 119 couples the power shaft 122 together with the roller brush shaft 112. When the roller brush device 100 is in operation, the power from the power shaft 122 is transmitted to the brush shaft 112, and the roller brush shaft 112 rotates together with the power shaft 122 to achieve surface cleaning. It is to be understood that the illustrated coupling structure is only exemplary, and the coupling structure may also employ any other suitable manner.

[0026] In some embodiments, as shown in FIG. 2 and FIG. 3, the roller brush shaft 112 comprises bristles and/or brush cloth (i.e., the cleaning member 117) arranged along an entire outer circumference in an axial direction of the roller brush, thereby significantly improving the cleaning capability of the roller brush along the edges. In order to detach the roller brush assembly 110, a manner of drawing out the roller brush assembly 110 from the side is usually designed. According to such a design, when the roller brush assembly 110 is removed, the roller brush assembly 110 moves along the axis of the roller brush. This makes it difficult to remove the roller brush assembly.

[0027] The Inventor has done a lot of analysis on the reasons behind this technical problem, and found that the main reasons for the difficulty in removing the roller brush assembly are as follows. Firstly, a contact area between the roller brush assembly 110 and the surface is relatively large, resulting in a relatively large static friction force; in addition, the coupling fitting between the power shaft 122 (such as a spline) of the base 120 and the coupling 119 (such as a key groove) of the roller brush assembly 110 also produces a static friction force. These static friction forces will prevent the user from removing the roller brush assembly 110 in the axial direction of the roller brush. At the same time, more and more application scenarios show that users are more inclined to remove the roller brush assembly 110 with one hand, which means higher release requirements. In view of this, the present disclosure provides a release device 130. Rotation of a release knob of the release device are configured to synchronously provide two functions, i.e., a locking for locking the roller brush assembly with the base is released, and an assisting force for removing the roller brush assembly may also be provided through the rotation. Thus, the user may easily remove the roller brush assembly 110 without increasing user operations.

[0028] In some embodiments, as shown in FIG. 2-FIG. 5, the release device 130 comprises a knob 132 mounted on the roller brush assembly 110 and an assisting device 140 actuable by the knob 132. The knob 132 is disposed on a side of the roller brush assembly 100 and can rotate about the axis of the roller brush by a certain angle. The locking between the base 120 and the roller brush assembly 110 may be released while the knob 132 is rotated, thereby allowing the base 120 and the roller brush assembly 110 to be unlocked from each other. In addition, the assisting device 140 is also actuated while

the knob 132 is rotated, so that at least a part of the assisting device 140 contacts the base 120 to provide a reaction force along the axis of the roller brush through the contact. The reaction force is in the axial direction of the roller brush and is opposite to a movement direction of at least a portion of the assisting device 140. Therefore, the reaction force may counteract the aforementioned static friction force that hinders the removal of the roller brush assembly 110, so that the removal of the roller brush assembly 110 is more labor-saving.

[0029] In some embodiments, as shown in FIG. 2 and FIG. 3, the assisting device 140 comprises a push rod 142 mounted in the roller brush shaft 112 and extending along the axis of the roller brush. During rotation of the knob 132 in a predetermined direction, the rotation of the knob 132 may drive the push rod 142 to move in the direction of the roller shaft, and cause the push rod 142 to contact a corresponding component of the base 120 to provide a reaction force via the corresponding component.

[0030] As shown in FIG. 2, in an initial state where the knob 132 is not rotated, this state may correspond to a state where the base 120 and the roller brush assembly 110 are locked to each other. In a state where the base 120 and the roller brush assembly 110 are locked to each other, the push rod 142 is disposed adjacent to the base 120. As an example, the push rod 142 may abut against the base 120 or be spaced apart from the base 120 by a small gap. When the base 120 and the roller brush assembly 110 need to be unlocked to remove the roller brush assembly 110, the user may rotate the knob 132. As shown in FIG. 3, during rotation of the knob 132, the push rod 142 moves linearly along the roller brush axis away from the knob 132 to abut against a component of the base 120. As a result, a reaction force for removing the roller brush assembly 110 may be provided via the component and can be used as a removal assisting force. The direction of the reaction force is along the axis of the roller brush and opposite to the moving direction of the push rod 142, so the reaction force may counteract the static friction force that hinders the removal of the roller brush assembly, such as the static friction force between the roller brush and the surface. It is to be understood that although in the illustrated embodiment, the push rod is separated from the base 120 by a certain distance in the locked state, this is only exemplary, and the push rod is not necessarily separated from the base 120 by a certain distance in the locked state as long as the push rod does not interfere with the movement of the base 120.

[0031] In the illustrated embodiment, the release operation member is shown as a knob, and the locking between the base 120 and the roller brush assembly 110 is released by the rotation action of the knob. It is to be understood that this is only exemplary, and the release operating member may be implemented as a button or other suitable form, the locking between the base 120 and the roller brush assembly 110 may be released by pressing the button, and simultaneously the assisting

force for removing the roller brush assembly 110 may be provided during the actuation operation. Although in the description of the following embodiments, the knob is taken as an example for illustration, and the release operation member implemented as the button or other form may also be included in the scope of the present disclosure.

[0032] In some embodiments, as shown in FIG. 3 and FIG. 4, a member of the base that is in contact with the push rod is the power shaft 122. When the push rod 142 contacts the power shaft 122, a reaction force is provided via the power shaft 122, and the reaction force also advantageously eliminates or reduces the static friction force between the coupling of the roller brush and the transmission shaft of the motor, further enabling the user to remove the roller brush assembly conveniently. It is to be understood that the base member in contact with the push rod may also be other parts.

[0033] In some embodiments, the roller brush shaft 112 may include a through hole 114 extending along the axis of the roller brush. The push rod 142 may be received in the through hole 114. A wall of the through hole 114 may guide the linear movement of the push rod 142. In the state where the roller brush assembly is not removed, the push rod 142 may for example retract in the through hole 114, to prevent the presence of the push rod 142 from interfering with the force transmission between the coupling 119 and the power shaft 122 of the roller brush assembly 110. As shown in FIG. 4, the push rod 142 and the roller brush shaft 112 may extend coaxially and protrude from the through hole 114 on a side away from the knob 132 to abut against the power shaft 122 during the rotation of the knob 132.

[0034] In some embodiments, as shown in FIG. 4, the assisting device 140 may further include a return spring 144. After the roller brush assembly 110 is removed, the return spring 144 may be used to return the push rod 142. When the knob 132 moves in the unlocking direction, the push rod 142 moves along with it, and the movement of the push rod compresses the spring 144 to store energy. After the roller brush assembly 110 is removed, and after the contact between the push rod 142 and the power shaft 122 is made, the push rod 142 returns to an initial position under the action of a compression elastic force of the return spring 133.

[0035] In some embodiments, as shown in FIG. 2-FIG. 5, the knob 132 may include an operating portion 134 disposed on the user side and a driving portion 136 located on a side opposite to the operating portion. The driving portion is configured to push the push rod 142 to move during the rotation of the knob 132. The driving portion 136 may be embodied as any driving mechanism in any suitable form, as long as it is capable of pushing the push rod 142 to move through the rotation of the knob 132.

[0036] In some embodiments, as shown in FIG. 5, the driving portion 136 comprises a protrusion protruding on a side of the knob 132 opposite to the operating portion.

The push rod 142 may be pushed by the protrusion. In some embodiments, the protrusion is arranged eccentrically with respect to a center of rotation of the knob 132. Therefore, the assisting force for pushing the push rod 142 for removal may be provided conveniently through the rotation of the protrusion. In some embodiments, the driving portion 136 may employ a non-eccentric arrangement.

[0037] In some embodiments, the push rod 142 may include an engaging portion 146 adapted to engage with the driving portion. The engaging portion 146 may interact with the driving portion 136 to facilitate providing the aforementioned assisting force. The engaging portion 146 may be formed in any suitable shape. In some embodiments, the engaging portion 146 may be formed into a shape suitable for engaging with the protrusion, for example, it may be formed into a shape capable of providing a height difference in the assisting direction. The engaging portion as shown in FIG. 5 may be formed as a slope surface, a smooth curved surface, etc., so that as the operating portion (such as the knob 132) is actuated, a substantially linear movement process of the push rod 142 is obtained, which is convenient for the user to operate more smoothly. During the unlocking process, as the knob 132 is rotated, the protrusion may abut against different positions of the engaging portion 146 to make the push rod move in the assisting force.

[0038] In some embodiments, the push rod 142 may include a guide rail which guides the driving portion 136 and can be driven by the driving portion 136. The guide rail may for example extend protrudingly or concavely from a side wall portion or other portion. The driving portion 136 may include one or more laterally protruding teeth. During the rotation of the knob 132, the driving portion 136 may push the push rod 142 to move through the engagement of the teeth and the guide rail. Thus, it may be ensured that the knob may reliably push the push rod 142 to move. That is, there is an actuable member coupled between the push rod 142 and the release operation member, so that as the user operates the release operation member, the push rod 142 is actuated simultaneously, and the assisting force is provided as the push rod 142 moves. The exemplary description of the actuable member should not be considered as a limitation to the actuation idea in the present disclosure.

[0039] The structural details and operating principles of the locking device of the release device 130 cooperating with the knob according to the embodiment of the present disclosure will be described below with reference to FIG. 6-FIG. 11. In some embodiments, as shown in FIG. 6-FIG. 11, the release device 130 further comprises a locking member 152 driven by the knob 132. The roller brush assembly 110 may include a sliding groove 154. The locking member 152 is configured to move in the sliding groove 154. In a state where the base 120 and the roller brush assembly 110 are locked to each other, the locking member 152 and the base 120 engage together to fix the base 120 and the roller brush assembly

110 to each other. When the knob 132 is rotated to unlock the base 120 and the roller brush assembly 110, the locking member 152 is moved along the sliding groove 154 to the unlocked position as the knob 132 rotates, and the locking member 152 disengages from the base 120 to allow the user to remove the roller brush assembly 110 from the base 120. In the illustrated embodiment, the sliding groove 154 is disposed in a plane perpendicular to the axis of the roller brush. It should be understood that in the illustrated embodiment, the sliding groove 154 is disposed in the roller brush assembly 110; this is merely exemplary, and the sliding groove 154 may be disposed on the base 120 in other embodiments.

[0040] In some embodiments, as shown in FIG. 6-FIG. 8, the knob 132 may drive the locking member 152 through a link 156. One end of the link 156 is pivotally connected to the knob 132, and the other end of the link 156 is pivotally connected to the locking member 152. FIG. 6 shows a schematic view before the knob 132 is rotated and when the locking member 152 is in a locked state. FIG. 7 is a partial sectional view of the state shown in FIG. 6. As shown in FIG. 6 and FIG. 7, in a state where the base 120 and the roller brush assembly 110 are locked to each other, the locking member 152 is located at a position of the sliding groove on the left. At this position, a lock tooth 153 of the locking member 152 is locked with the base 120. As shown in FIG. 8, the base 120 may include a lock hole 125. The lock tooth 153 may engage the lock hole 125 to lock the base 120 together with the roller brush assembly 110. At this time, when the user rotates the knob 132 in the unlocking direction (i.e., a counterclockwise direction in FIG. 6), the rotation of the knob 132 pulls the link 156, and the pull of the link 156 causes the locking member 152 to move from the left to the right in the sliding groove 154, thereby unlocking the lock tooth 153 from the base 120. In particular, the lock tooth 153 disengages from the lock hole 125 to unlock the base 120 from the roller brush assembly 110.

[0041] As shown in FIG. 8, a return spring 159 for returning the locking member 152 from the unlocked position to the locked position may be provided. A return spring 159 may be disposed between the locking member 152 and a cleaning member 117. During the movement of the locking member 152 from the left to the right, the return spring 159 is compressed. After the locking tooth 153 is unlocked from the base 120 and after the roller brush assembly 110 is removed from the base 120, the return spring 159 may return the locking member 152 to its original position under the action of a compression force. In the embodiment shown in FIG. 8, the locking member 152 may include a lock tooth 153 protruding from the main body, the main body may define a cavity wall suitable for arranging the return spring, and a pivoting portion pivotally connected with the link may be disposed on a side of the main body opposite to the lock tooth 153. It should be understood that this is exemplary only and that the locking member 152 may be formed in any other suitable shape.

[0042] In some embodiments, as shown in FIG. 6 and FIG. 7, the pivoting portion of the link 156 and the locking member 152 comprises a pivot disposed on one of the link 156 and the locking member 152 and a waist-shaped hole 158 disposed on the other of the link 156 and locking member 152. The waist-shaped hole 158 is in a shape allowing the pivot to move linearly in the waist-shaped hole 158. As an example, the waist shape is elongated, oval, rectangle with rounded corners and the like. The waist-shaped hole 158 may prevent a case in which the locking member 152 is locked and cannot be driven by the link. Specifically, as shown in FIG. 6, when the moving direction of the locking member 152 and the direction of the link 156 are on the same straight line, the locking member 152 and the link 156 are rigidly stuck. As a result, when the roller brush is mounted on the floor brush again, the locking member 152 cannot move in the unlocking direction because the locking member 152 and the link 156 are stuck. In particular, a protruding tooth at a front end of the locking member 152 abuts against an edge of a groove, so that it cannot enter the groove smoothly. According to the embodiment of the present disclosure, the setting of the waist-shaped hole may effectively prevent the problem that the locking portion 152 and the link 156 are stuck so that they cannot be unlocked.

[0043] In some embodiments, as shown in FIG. 9, instead of the waist-shaped hole 158, the sliding direction of the locking member 152 (that is, the extending direction of the sliding groove 154 in the illustrated embodiment) is set to a non-zero angle with respect to the extension direction of the link 156. As shown in FIG. 9, in a state where the locking member 152 and the link 156 are locked to each other, the locking member 152 and the link 156 are initially arranged at an acute angle θ . Since the locking member 152 and the link 156 are initially arranged at the acute angle θ , a dead point position where the locking member 152 and the link 156 appear on the same straight line is avoided. In an angular range of the knob from the locked position to the unlocked position, the sliding direction of the locking member 152 and the extending direction of the link 156 are always set at a non-zero angle. In this case, it is also possible to effectively prevent the case in which the locking member 152 is locked and cannot be driven by the link.

[0044] FIG. 10 and FIG. 11 show schematic views of a locking device according to a further embodiment of the present disclosure. The embodiment of FIG. 10-FIG. 11 is similar to the embodiment shown in FIG. 6-9, and the difference is that instead of using the link to drive between the knob and the locking member, in the embodiment of FIG. 10-FIG. 11 the knob 132 directly drives the locking member 152, and the locking structure between arrangement manners of the base 120 and the locking member 152 is also different from the previous embodiment, especially the corresponding lock hole 125 or the locking position in the base 120. In this embodiment, the lock hole 125 is disposed at a position closer to the roller brush shaft, and a direction in which the lock-

ing member 152 retreats out of the lock hole 125 (i.e., a movement direction upon unlocking) is a direction away from the roller brush shaft. However, in the embodiment shown in FIGS. 6-9, the direction in which the locking member 152 retreats out of the lock hole is a direction adjacent the roller brush shaft.

[0045] As shown in FIG. 10 and FIG. 11, the knob 132 may include a toggle portion 136 protruding laterally from the knob 132. The base 120 is provided with a lock hole 125 on a side adjacent to the knob 132. The lock member 152 is provided with a lock tooth 153 on a side adjacent to the knob 132. The locking member 152 engages with the lock hole 125 provided in the base 120 to lock the base 120 together with the roller brush assembly 110. When the roller brush assembly 110 needs to be removed from the base 120, it may be performed by rotating the knob. Specifically, while the user rotates the knob 132 counterclockwise from the locked position shown in FIG. 10, the toggle portion 136 will move counterclockwise from the locked position shown in FIG. 10 together with the knob. At the same time, the toggle portion 136 will abut against and push the locking member 152 to move from the locked position shown in FIG. 10 toward the unlocked position along the sliding groove (i.e., a direction from the right to the left in FIG. 10). FIG. 11 further shows the details of the structure. As shown in FIG. 11, since the lock tooth and the locking member 152 are an unitary structure, while the locking member moves from a side close to the knob 132 to a side away from the knob (i.e., a direction from the left to the right in FIG. 11), the lock tooth 153 also disengages from the lock hole 125 of the base 120. Since the lock tooth 153 is unlocked and disengaged from the lock hole 125, the base 120 and the roller brush assembly 110 are unlocked. After the base 120 and the roller brush assembly 110 are unlocked, the user may also remove the roller brush assembly conveniently. In addition, since the rotation of the knob 132 also provides assistance for removing the roller brush assembly, the user may remove the roller brush assembly with a little force.

[0046] According to the roller brush device of the embodiment of the present disclosure, the release device is implemented as a linkage operation member. When the user needs to detach the roller brush assembly, he/she only needs to use one hand to operate the release operation member on one side of the roller brush assembly. As the release operation member acts, the mutual locking of the base and the roller brush assembly can be released first. However, at this time, the surface cleaning apparatus still contacts the cleaning surface, and there is a large friction force between the cleaning member and the cleaning surface, and a force needs to be applied to draw it in the absence of the assisting device. According to the roller brush device of the embodiment of the present disclosure, as the action of the release operation member can drive the assisting device in the roller shaft to move to provide the assisting force for removing the roller brush assembly, the user may easily remove the

roller brush device with one hand, and the user experience can be improved.

[0047] Further, while operations are depicted in a particular order, this should not be understood as requiring that such operations are performed in the particular order shown or in sequential order, or that all illustrated operations are performed to achieve the desired results. In certain circumstances, multitasking and parallel processing may be advantageous. Likewise, while several specific implementation details are contained in the above discussions, these should not be construed as limitations on the scope of the subject matter described herein, but rather as descriptions of features that may be specific to particular implementations. Certain features that are described in the context of separate implementations may also be implemented in combination in a single implementation. Rather, various features described in a single implementation may also be implemented in multiple implementations separately or in any suitable sub-combination.

[0048] Although the subject matter has been described in language specific to structural features and/or methodological acts, it is to be understood that the subject matter specified in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed as example forms of implementing the claims.

[0049] The descriptions of the various embodiments of the present invention have been presented for purposes of illustration, but are not intended to be exhaustive or limited to the embodiments disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art without departing from the scope and spirit of the described embodiments. The terminology used herein was chosen to best explain the principles of the embodiments, the practical application or technical improvement over technologies found in the marketplace, or to enable others of ordinary skill in the art to understand the embodiments disclosed herein.

Claims

1. A roller brush device (100), comprising:

a base (120);
a roller brush assembly (110) detachably mounted to the base (120) and comprising a roller brush shaft (112) that is configured to rotate about an axis of the roller brush; and
a release device (130) comprising a release operation member mounted on the roller brush assembly (110) and configured to be actuated to release a locking between the base (120) and the roller brush assembly (110), and to provide an assisting force for removing the roller brush assembly (110) duration the actuation.

2. The roller brush device (100) according to claim 1, wherein the release operation member is a knob (132), and the release device (130) further comprises an assisting device (140) driven by the knob (132).

3. The roller brush device (100) according to claim 2, wherein the assisting device (140) comprises a push rod (142) mounted in the roller brush shaft (112) and extending along the axis of the roller brush, and the push rod (142) is configured to be driven to move along the axis of the roller brush away from the knob (132) during rotation of the knob (132) to abut against the base (120).

4. The roller brush device (100) according to claim 3, wherein the roller brush shaft (112) comprises a through hole (114) extending along the axis of the roller brush and configured to receive the push rod (142), and the push rod (142) and the roller brush shaft (112) coaxially extend.

5. The roller brush device (100) according to claim 3, wherein the push rod (142) is configured to abut against a power shaft (122) of the base (120), and the power shaft (122) engages the roller brush shaft (112) via a spline to transmit power from the power shaft to the roller brush shaft (112).

6. The roller brush device (100) according to any of claims 1-5, wherein the release device (130) further comprises a return spring (144) for returning the push rod (142) after the roller brush assembly (110) is removed.

7. The roller brush device (100) according to any of claims 2-5, wherein the knob (132) comprises an operating portion (134) disposed on a user side and a driving portion (136) located on a side opposite to the operating portion, and the driving portion (136) is configured to push the push rod (142) to move during the rotation of the knob (132).

8. The roller brush device (100) according to claim 7, wherein the driving portion (136) comprises a protrusion protruding from the knob (132) on a side opposite to the operating portion, and the protrusion is arranged eccentrically with respect to a center of rotation of the knob (132).

9. The roller brush device (100) according to claim 7, wherein the push rod (142) comprises an engaging portion (146) adapted to engage with the driving portion, and the engaging portion comprises a slope, a guide rail or a guide groove.

10. The roller brush device (100) according to any of claims 1-5, 8 and 9, wherein the release device (130) further comprises a locking member (152) driven by

the operation release member, and the locking member (152) is movably disposed relative to the base (120) to slide between a locked position where the locking member engages the base (120) and an unlocked position where the locking member disengages from the base (120). 5

11. The roller brush device (100) according to claim 10, wherein the release operation member comprises a knob (132), the knob (132) comprises a toggle portion (136) protruding laterally from the knob (132), and during rotation of the knob (132), the toggle portion (136) is configured to push the locking member (152) to move from the locked position to the unlocked position. 10 15

12. The roller brush device (100) according to claim 10, wherein the release operation member comprises a knob (132), the knob (132) drives the locking member (152) through a link (156), one end of the link (156) is pivotally connected to the knob (132), and the other end of the link (156) is pivotally connected to the locking member (152). 20

13. The roller brush device (100) according to claim 12, wherein a pivoting portion of the link (156) and the locking member (152) comprises a pivot disposed on one of the link (156) and the locking member (152) and a waist-shaped hole (158) disposed on the other of the link (156) and locking member (156), and the waist-shaped hole (158) allows the pivot to move linearly in the waist-shaped hole (158). 25 30

14. The roller brush device (100) according to claim 11, wherein a sliding direction of the locking member (152) is set to a non-zero angle with respect to an extension direction of the link (156). 35

15. A surface cleaning apparatus, comprising 40
the roller brush device (100) according to any of claims 1-14; and
a main body assembly configured to support the roller brush device (100). 45

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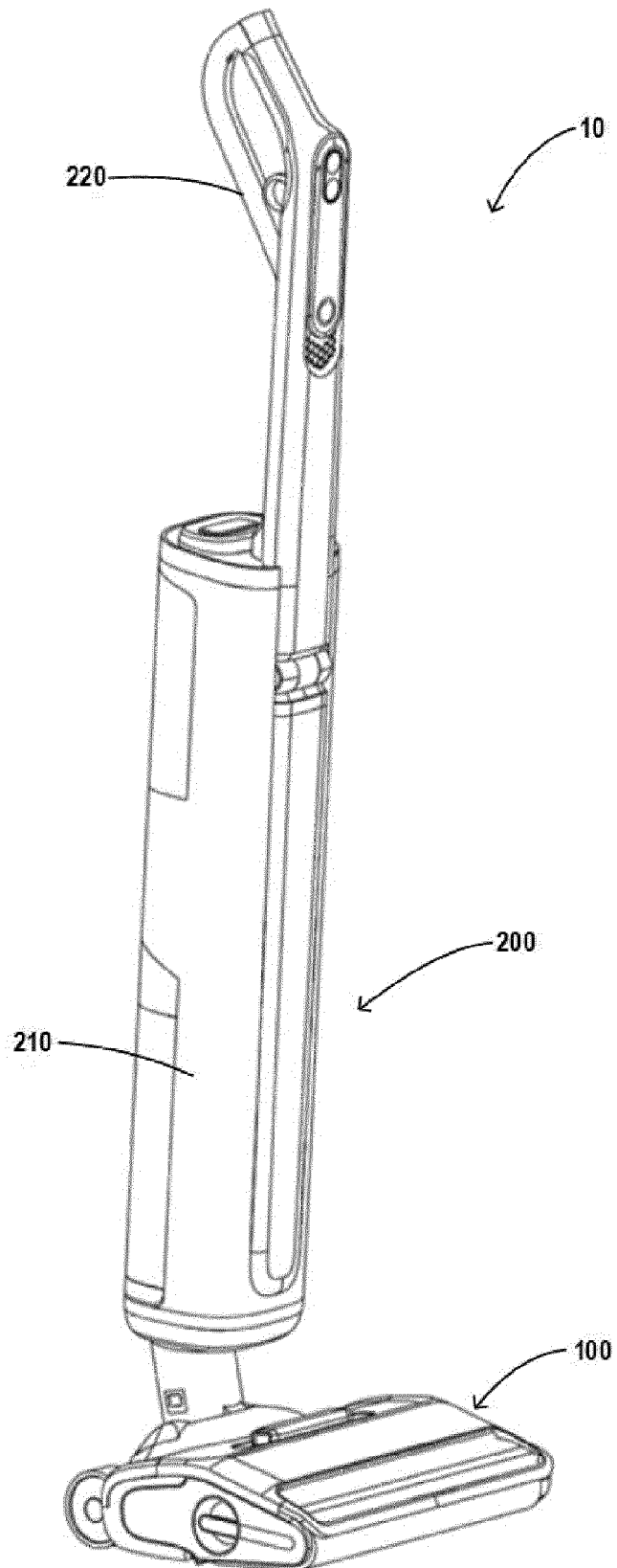


FIG. 1

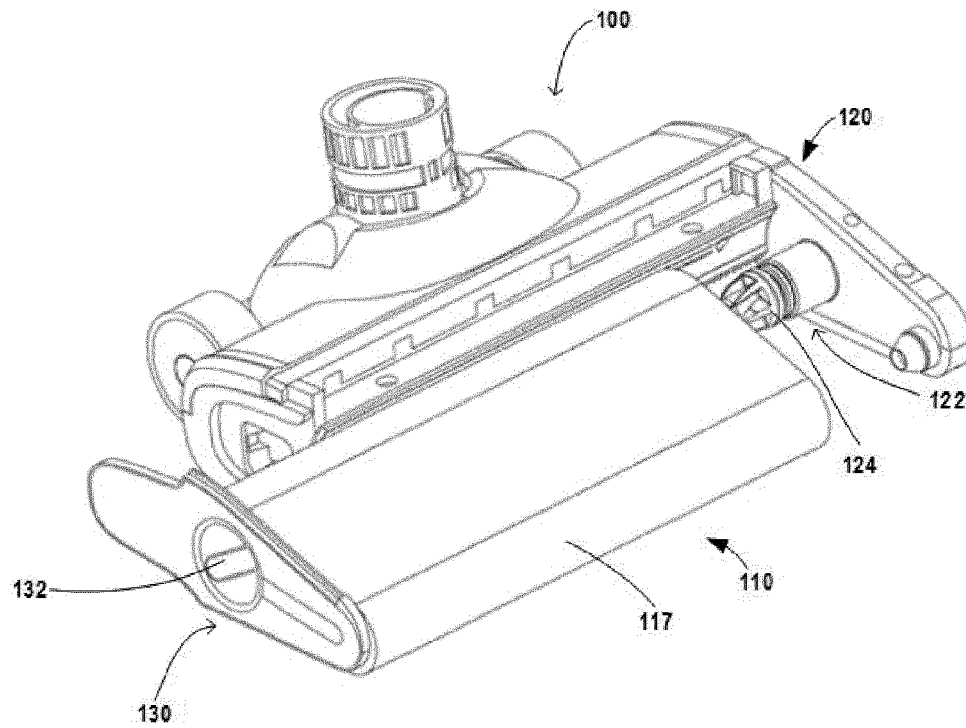


FIG. 2

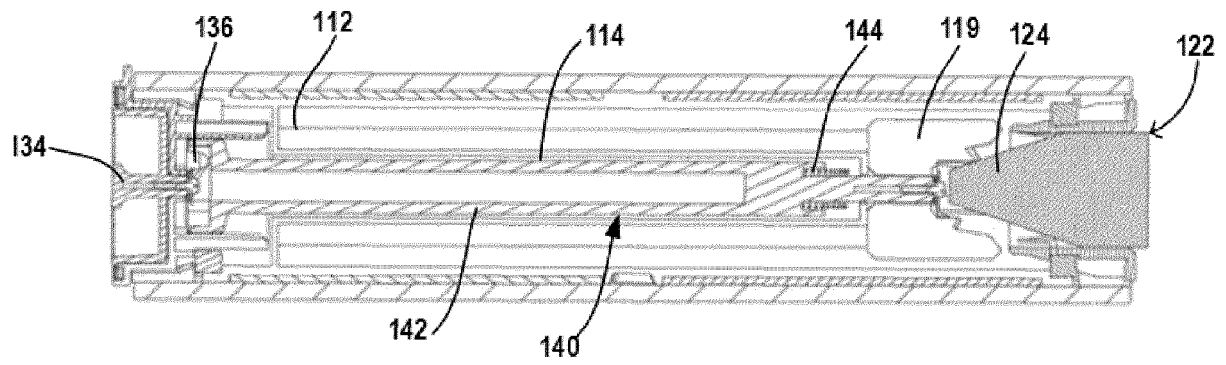


FIG. 3

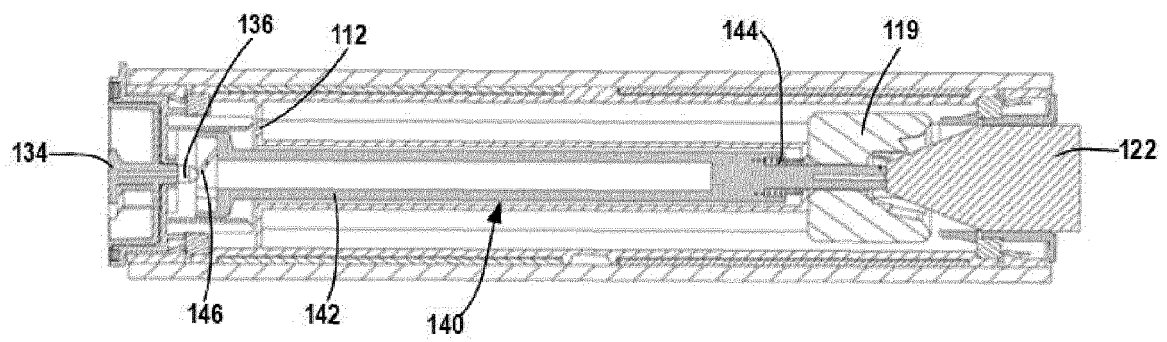


FIG. 4

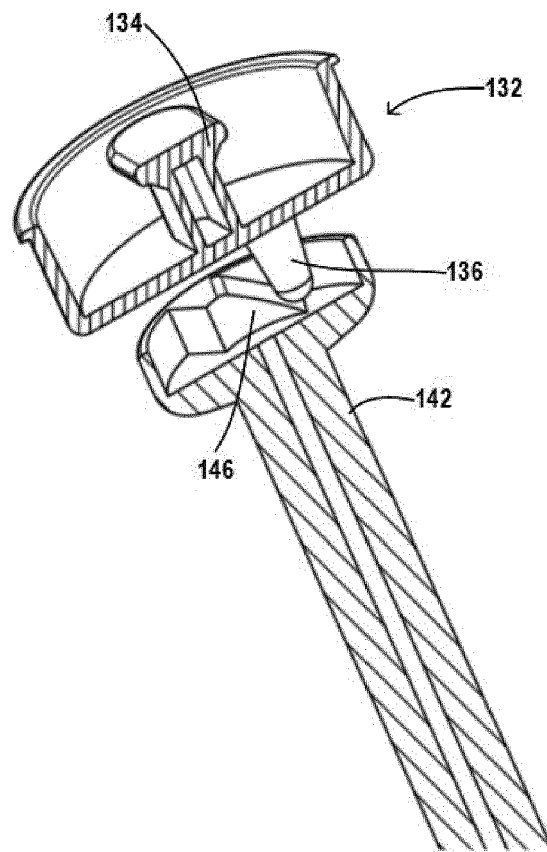


FIG. 5

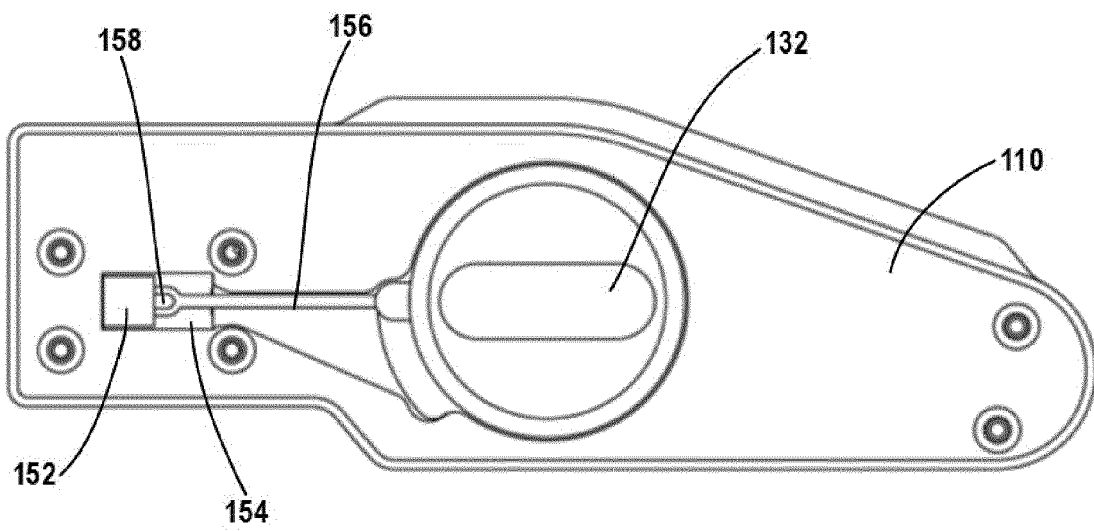


FIG. 6

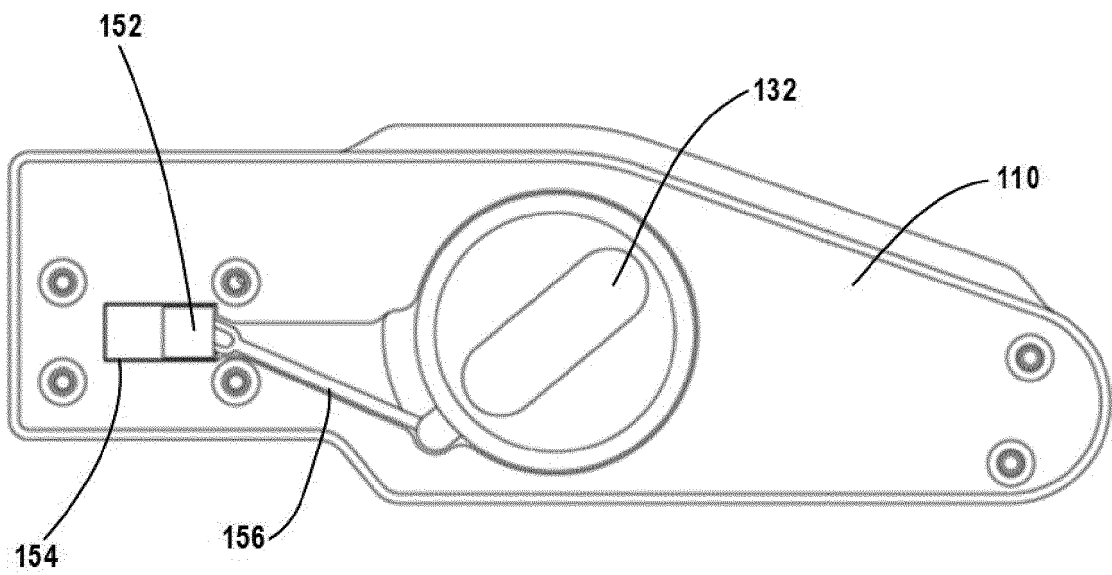


FIG. 7

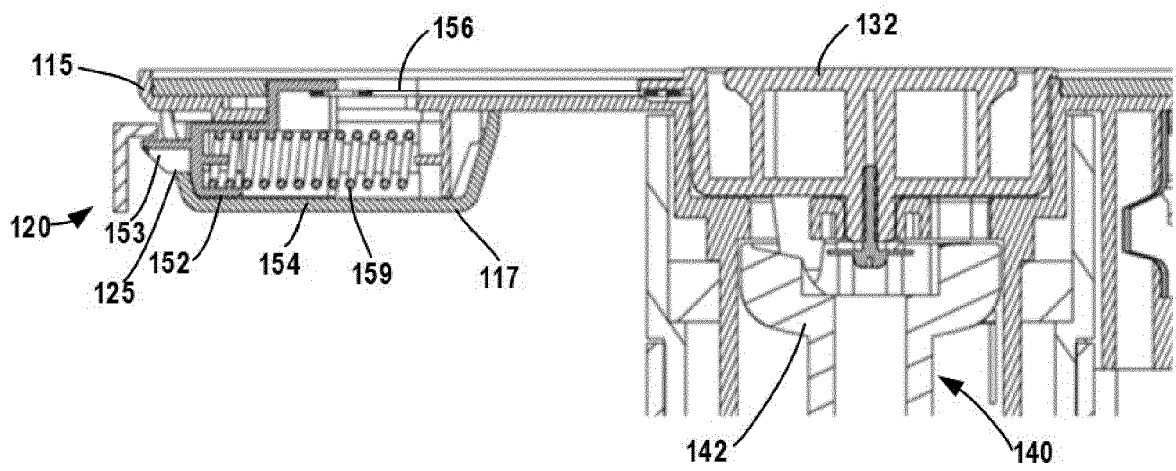


FIG. 8

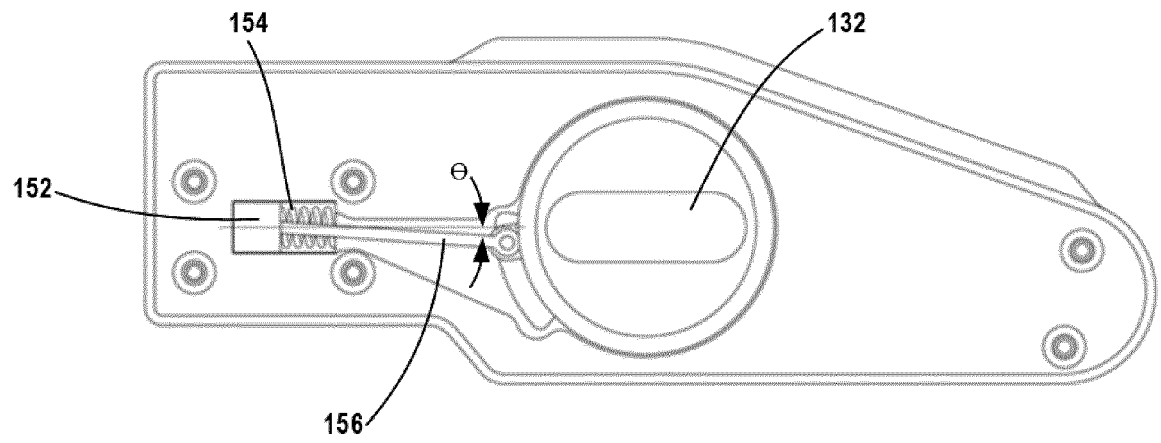


FIG. 9

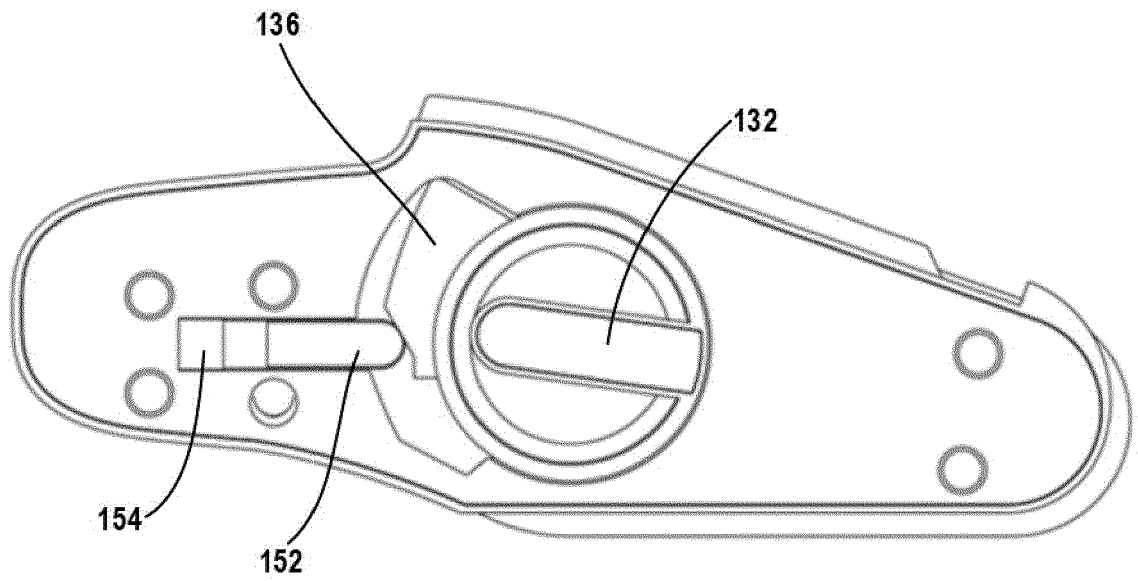


FIG. 10

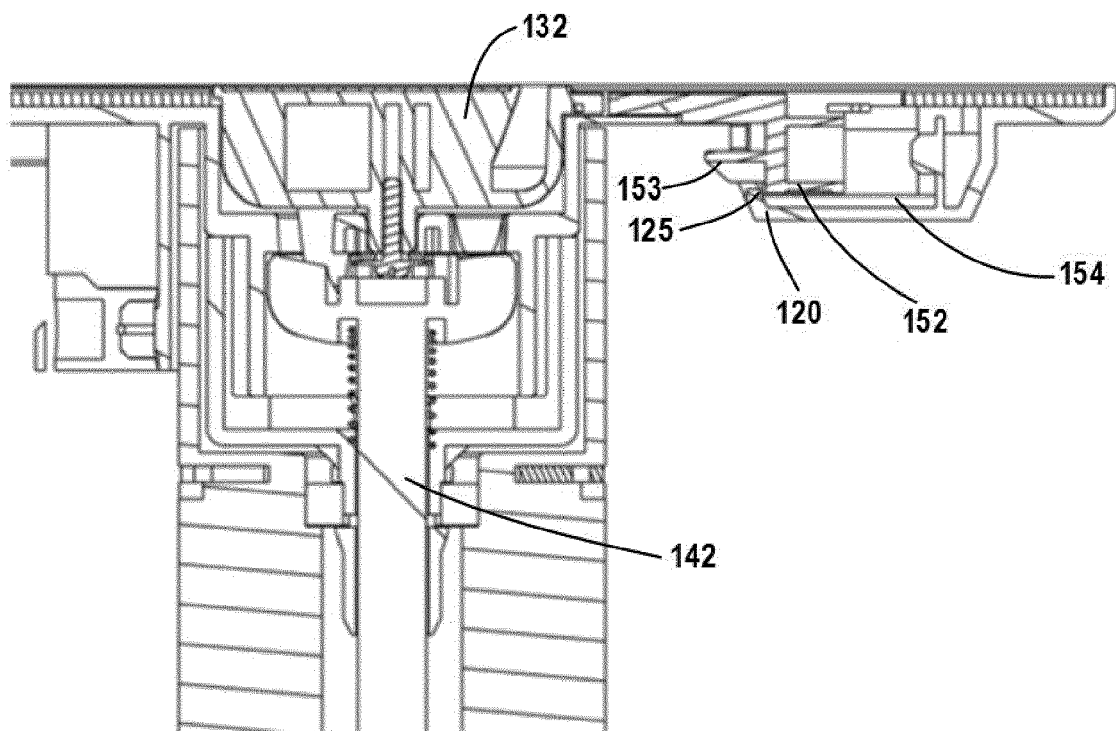


FIG. 11



EUROPEAN SEARCH REPORT

Application Number

EP 23 16 1255

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A	* paragraph [0027] - paragraph [0042]; figures *	3-14	A47L5/30 A47L9/04

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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		15 August 2023	Masset, Markus
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

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The members are as contained in the European Patent Office EDP file on
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