



(51) International Patent Classification:

A47L 11/24 (2006.01) A47L 11/40 (2006.01)
A47L 9/04 (2006.01) A47L 9/12 (2006.01)
A47L 9/06 (2006.01)

(21) International Application Number:

PCT/US2024/051714

(22) International Filing Date:

17 October 2024 (17.10.2024)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

63/544,493 17 October 2023 (17.10.2023) US

(71) Applicant: **SHARKNINJA OPERATING LLC**
[US/US]; 89 A Street, Suite 100, Needham, Massachusetts
02494 (US).

(72) Inventor: **LESSARD, Derek**; 31 Tonawanda St, Dorchester,
Massachusetts 02124 (US).

(74) Agent: **CARROLL, Kevin et al.**; Grossman Tucker Per-
reault & Pflieger, PLLC, 55 South Commercial Street, Man-
chester, 03101 (US).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ,
CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG,
KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY,
MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA,
NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO,
RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH,
TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS,
ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, CV,
GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST,
SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ,
RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ,
DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT,
LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE,
SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN,
GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: VACUUM CLEANING HEAD WITH REMOVABLE CLEANING ROLLER

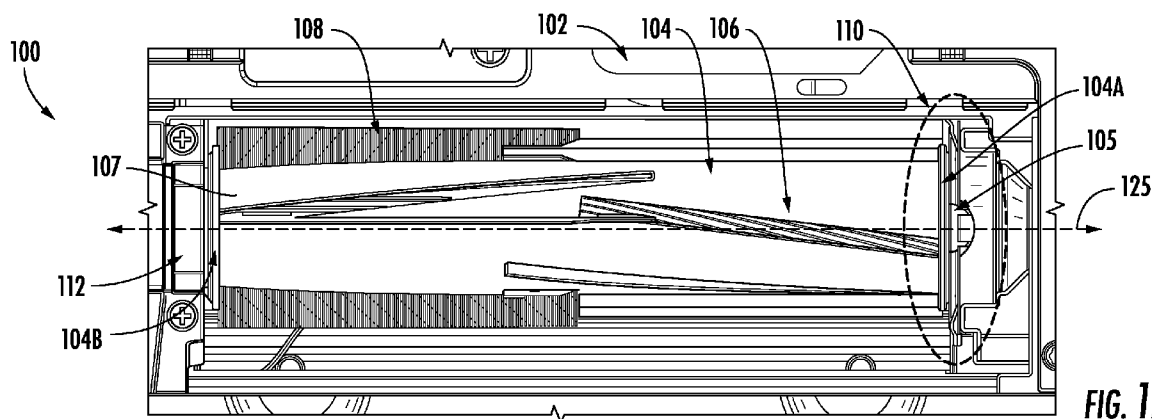


FIG. 1A

(57) Abstract: A removable cleaning roller for a cleaning head for a vacuum system may include a main body, a first roller coupling region and a second roller coupling region, the first roller coupling region and the second roller coupling region being generally disposed at opposite ends of the main body and at either end of a vacuum orifice defined in the main body, the first roller coupling region including a plate member having a resiliently deformable section and a dimple defined in the resiliently deformable section, and a cleaning roller having a first end portion and a second end portion, the second end portion being removably coupled to the second roller coupling region and the first end portion being removably coupled to the first roller coupling region, the cleaning roller having a protrusion on the first end portion to be received in the dimple.



VACUUM CLEANING HEAD WITH REMOVABLE CLEANING ROLLER

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims the benefit of U.S. Provisional Application Serial No. 63/544,493 filed on October 17, 2023, entitled Vacuum Cleaning Head with Removable Cleaning Roller, which is fully incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure is generally directed to a vacuum cleaning head, and more particularly to a vacuum cleaning head with a removable cleaning roller.

BACKGROUND

[0003] Surface cleaning devices, such as vacuum cleaners, may include a suction motor and a rotatable agitator (e.g., a roller) configured to agitate a surface to be cleaned (e.g., a floor). Agitation of the surface to be cleaned may encourage debris residing on the surface to be cleaned to become entrained within an airflow generated by the suction motor.

[0004] The rotatable agitator includes a driven end and a free end. The driven end is configured to couple with a drive motor such that the drive motor causes the rotatable agitator to rotate. The free end may be configured to be received within a bearing cap. The bearing cap includes a bearing configured to cooperate with the rotatable agitator such that the free end rotates within the bearing cap. The bearing cap can be configured to cooperate with a sole plate of the surface cleaning device to couple the rotatable agitator to the surface cleaning device. In use, fibrous debris (e.g., hair or string) may become entangled within the bearing cap, impeding (e.g., preventing) rotation of the rotatable agitator.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] Features and advantages of various embodiments of the claimed subject matter will become apparent as the following Detailed Description proceeds, and upon reference to the Drawings, wherein like numerals designate like parts, and in which:

[0006] FIG. 1A is an underside view of an example cleaning head according to embodiments of the present disclosure;

[0007] FIG. 1B is close-up perspective view of the first roller coupling region of FIG. 1A according to embodiments of the present disclosure;

[0008] FIG. 1C is an isolated perspective view of the plate member and cleaning roller of FIG. 1A according to embodiments of the present disclosure;

[0009] FIG. 1D is an isolated cross-sectional view of the plate member and cleaning roller of FIG. 1A according to embodiments of the present disclosure;

[0010] FIG. 1E illustrates an example embodiment of the second end portion of the cleaning roller of FIG. 1A according to embodiments of the present disclosure;

[0011] FIG. 1F illustrates an example embodiment of the second end portion of the cleaning roller of FIG. 1A according to embodiments of the present disclosure;

[0012] FIG. 1G illustrates an example embodiment of the second end portion of the cleaning roller of FIG. 1A according to embodiments of the present disclosure;

[0013] FIG. 1H illustrates an example embodiment of the second end portion of the cleaning roller of FIG. 1A according to embodiments of the present disclosure;

[0014] FIG. 2A illustrates another embodiment of a cleaning head according to embodiments of the present disclosure;

[0015] FIG. 2B illustrates another view of the cleaning head of FIG. 2A according to embodiments of the present disclosure; and

[0016] FIG. 3 illustrates an example vacuum cleaning system that may be used with the cleaning head of FIGS. 1 and/or 2 according to one embodiment of the present disclosure.

[0017] FIG. 4 illustrates another example vacuum cleaning system that may be used with the cleaning head of FIGS. 1 and/or 2 according to one embodiment of the present disclosure.

[0018] Although the following Detailed Description will proceed with reference being made to illustrative embodiments, many alternatives, modifications and variations thereof will be apparent to those skilled in the art.

DETAILED DESCRIPTION

[0019] The present disclosure is generally directed to a vacuum cleaning head with a removable cleaning roller. The vacuum cleaning head may be coupled to a robotic cleaner, an upright cleaner, a handheld cleaner, and/or any other cleaner.

[0020] In at least one embodiment, the cleaning head includes a plate configured to cooperate with a removable cleaning roller. In one embodiment, the plate has a resiliently flexible portion and a dimple formed in the resiliently flexible portion. In another embodiment, the plate may pivot in response to removal and insertion of the roller. The plate is oriented on one side of the cleaning

roller. The cleaning roller includes a bearing (e.g., a ball bearing) or protrusion extending from a first end thereof. The bearing or protrusion is dimensioned to mate with the dimple so that, when the cleaning roller is installed into the cleaning head, the cleaning roller is coupled to the plate (and to the cleaning head) and is free to rotate within the dimple. Such a configuration may allow for the cleaning roller to be rotatably installed in the cleaning head without the use of a bearing cap, which may allow for a cleaning width of the cleaning roller to be increased and/or mitigate the effects of an ingress of fibrous debris (e.g., hair and/or string). Omission of the bearing cap may further allow for easier coupling of the cleaning roller with the cleaning head (e.g., a bearing cap may require alignment with one or more features of the cleaning head prior to coupling). The dimple may be configured to cooperate with the bearing or protrusion to prevent lateral and/or vertical movement of the cleaning roller, while allowing the cleaning roller to rotate.

[0021] In embodiments described herein, rotational cooperation between the protrusion on the roller and the dimple is accomplished by a single point of contact aligned with the rotational axis of the roller. The dimple may be formed having a generally spherical cross-section such that the focus of an interior surface of the dimple is aligned with the rotational axis of the roller (e.g., centerline axis of the roller). The dimple/protrusion arrangement may be generally defined as two tangent curved surfaces (e.g., hemispherically-shaped, parabolic shaped, hyperbolic-shaped, etc.), where the dimple has a greater radius of curvature than the protrusion. In this manner, the protrusion (and thus, the roller) can be “self-centering” within the dimple, such that roller tends to “return to center” within the dimple in response to rotational and lateral forces on the roller. The opposite end of cleaning roller (second end) is removably coupled to the cleaning head within a housing that may include, for example, drive mechanisms (e.g., gears, belts, etc.) to cause rotation of the cleaning roller.

[0022] FIG. 1A is an underside view of an example cleaning head 100 according to embodiments of the present disclosure. The cleaning head 100 may be part of a vacuum system (not shown in this figure) such as an upright vacuum system, canister vacuum system, handheld vacuum system, battery powered vacuum system, central vacuum system, robotic vacuum system, etc. The cleaning head 100 includes a main body 102 and a cleaning roller 104 having a first end portion 104A and a second end portion 104B disposed in the main body 102. The cleaning roller 104 has a length that spans a substantial portion of the length of the main body 102, as illustrated. The cleaning roller 104 is generally configured to rotate, and may include one or more bristle tracks

106 to provide cleaning as the main body 102 passes over flooring. The one or more bristle tracks 106 extend from a roller core 107.

[0023] The cleaning roller 104 is removably coupled to the main body 102 and disposed such that the cleaning roller 104 and/or bristle tracks 106 extend beyond the plane of the underside of the main body 102, i.e. so that the bristle tracks 106 make contact with flooring to be cleaned. While the cleaning roller 104 is shown as having bristle tracks 106, other configurations are possible. For example, the cleaning roller 104 may include (in addition to, or in the alternative to, the bristle tracks) one or more of a microfiber material, bristle tufts, flaps (e.g., fabric flaps, elastomeric flaps, and/or any other flap), and/or any other agitation material.

[0024] The cleaning roller 104 is disposed (e.g., removably) in a vacuum orifice 108 defined in the main body 102. The cleaning roller 104 also includes a protrusion 105 (or bearing) extending from the first end portion 104A of the cleaning roller 104, as illustrated. The protrusion 105 is generally centered on the end of the cleaning roller 104, as illustrated. The protrusion 105 may have a continuously convex cross-section. For example, the protrusion 105 may have a generally spherical cross-section to enable the cleaning roller 104 to be inserted into, and removed from, the main body 102 and to allow the cleaning roller 104 to rotate while minimizing friction, as will be described in greater detail below.

[0025] The main body 102 includes a first roller coupling region 110 configured to removably couple with the first end portion 104A of the cleaning roller 104 and a second roller coupling region 112 configured to removably couple with the second end portion 104B of the cleaning roller 104. The first roller coupling region 110 and the second roller coupling region 112 are generally disposed at opposite ends of the main body 102 and at either end of the vacuum orifice 108, as illustrated. With reference to FIG. 1B and continued reference to FIG. 1A, the first roller coupling region 110 includes a plate member 114 generally configured to receive the cleaning roller 104, and more particularly the protrusion 105 of the cleaning roller 104, in a “snap-fit” coupling to the plate member 114 to permit the cleaning roller 104 to rotate and to be removably coupled to the main body 102. The plate member 114 includes a first seam 116A and a second seam 116B and a resiliently deformable (or flexible) section 118 extending between the first and second seams 116A and 116B. In other words, the first and second seams 116A and 116B may at least partially define the resiliently deformable section 118. For example, when the plate member 114 is a monolithic body, the first and second seams 116A and 116B may act as reliefs that allow the

resiliently deformable section 118 to flex (or elastically deform) in response to a force applied thereto. In other words, the first and second seams 116A and 116B may be configured to provide resilient flexibility to the resiliently deformable section 118.

[0026] The plate member 114 also includes a dimple 120 at least partially defined by the resiliently deformable section 118. The dimple 120 may have a continuously concave cross-section (e.g., that is substantially complementary to a continuously convex cross-section of the protrusion 105). For example, the continuously concave cross-section may include a spherical portion. As shown, a portion of the dimple 120 is defined in the resiliently deformable section 118 and a portion of the dimple 120 is defined in the plate member 114 such that the first and second seams 116A and 116B extend at least partially through the dimple 120. In other words, the dimple 120 partially spans the resiliently deformable section 118 and the plate member 114 on either side of the resiliently deformable section 118. The plate member 114 may be formed of, for example, metal, plastic, composite materials, etc., and may have a stiffness that provides sufficient rigidity to prevent “slop” or unwanted movement of the cleaning roller 104 when the roller is coupled to the plate member. The resiliently deformable section may have sufficient deformation ability when the protrusion 105 is forced against it (as explained below), while having sufficient elasticity to return to an original configuration (i.e., a configuration when the cleaning roller 104 is removed from the main body 102) without permanently bending.

[0027] The dimple 120 is generally dimensioned to receive the protrusion 105 of the cleaning roller 104. For example, the dimple 120 may have a dimple diameter 121 (FIG. 1D) and the protrusion 105 may have a protrusion diameter 123 (FIG. 1D), wherein the dimple diameter 121 is greater than or equal to the protrusion diameter 123. When the dimple diameter 121 is greater than the protrusion diameter 123, the protrusion 105 is encouraged to self-center within the dimple 120 (e.g., the protrusion 105 is urged to move along the sidewall of the dimple 120 towards a centered position as a result of the complementary curved shapes of the dimple 120 and the protrusion 105). This configuration may further encourage a single point of contact between the dimple 120 and the protrusion 105.

[0028] The protrusion 105 may be formed of, for example, metal, plastic, composite materials, etc. In some embodiments, the protrusion 105 and/or dimple 120 may include a low friction coating, for example, a Teflon™ coating, etc. to provide reduced friction while the cleaning roller

104 is rotating. Of course, in other embodiments, other materials may be used to provide a lubricious interface between the protrusion 105 and the dimple 120.

[0029] In some embodiments, the plate member 114 may be rigidly affixed to the main body 102, for example, to minimize unwanted movement of the plate member 114 within the main body 102, and, thus, minimizing unwanted movement of the cleaning roller 104 when coupled to the plate member 114. In other embodiments, the plate member 114 may be removably affixed into the main body 102 using, for example, slots and/or channels in a “snap-fit” arrangement. This may enable, for example, removal of the plate member 114 for cleaning of the plate member 114, the vacuum orifice 108 and/or main body 102.

[0030] FIGS. 1C and 1D illustrate an isolated perspective view of the plate member and cleaning roller, and an isolated cross-sectional view of the plate member and cleaning roller, respectively. As illustrated in these figures, the plate member 114 is engaged with the protrusion 105 of the cleaning roller 104. The protrusion 105 is disposed between the plate member 114 and the cleaning roller 104. The protrusion 105 may be coupled (e.g., rotatably or non-rotatably) to, for example, the cleaning roller 104. In this example, the protrusion 105 may be configured to rotate with the cleaning roller 104 or the cleaning roller 104 may be configured to rotate relative to the protrusion 105.

[0031] In use, fibrous debris (e.g., hair, string, and/or any other fibrous debris) may become entangled about the cleaning roller 104. Entangled fibrous debris may migrate to one or more ends of the cleaning roller 104. For example, fibrous debris may migrate towards the protrusion 105 and become trapped between the plate member 114 and the cleaning roller 104 and wrap about the protrusion 105. As such, when the cleaning roller 104 is removed from the main body 102 (e.g., for servicing), any hair wrapped about the protrusion 105 may be pulled off the protrusion 105 by a user. Additionally, or alternatively, the protrusion 105 and/or the plate member 114 may include one or more fibrous debris cutting and/or grinding features configured to break up at least a portion of any fibrous debris wrapped about the protrusion 105.

[0032] As illustrated in FIG. 1D, the first end portion 104A of the cleaning roller 104 may include a central opening 122 defined along part of the length of the cleaning roller 104. The central opening 122 is generally dimensioned to receive a first end cap 124. The first end cap 124 may be removably attached to the cleaning roller 104 within the central opening, for example, in a “snap-fit” arrangement. The first end cap 124 may be coupled with the cleaning roller 104 such

that the first end cap 124 rotates together with the cleaning roller 104. The first end cap 124 may be configured to couple (e.g., rotatably or non-rotatably) with the protrusion 105. For example, and as shown, the first end cap 124 can include a recess 126 generally dimensioned to receive at least a portion of the protrusion 105. The first end cap 124 may also include an end flange portion 128 to cover the first end portion 104A of the cleaning roller 104.

[0033] As shown, the protrusion 105 is disposed between the first end cap 124 and the plate member 114. The protrusion 105 is rotatable relative to the first end cap 124 or the plate member 114. In the example shown, the protrusion 105 is formed separately from the first end cap 124 and the plate member 114. For example, the protrusion 105 may be a ball bearing configured to be disposed between the first end cap 124 and the plate member 114 such that the cleaning roller 104 rotates relative to the plate member 114. In another example, the protrusion 105 may be formed from the first end cap 124 or the plate member 114. In yet another example, the protrusion 105 may be formed from a stamped metal plate coupled to the first end cap 124, wherein the stamped metal plate includes a convex surface. The protrusion 105 may be formed of an abrasive resistant material, such as, for example, polyoxymethylene (POM). The protrusion diameter 123 may be less than a maximum roller core width 129 of the roller core 107 and/or a maximum first end cap width 131.

[0034] In the example shown in FIG. 1D, the protrusion 105 may include a substantially spherical shape and be configured to rotate relative to one of the cleaning roller 104 (e.g., the first end cap 124 of the cleaning roller 104) or the plate member 114. In one example, a substantially spherical protrusion 105 may be captured within the first end cap 124 such that the substantially spherical protrusion 105 rotates relative to the first end cap 124. Such a configuration allows the cleaning roller 104 to rotate relative to the plate member 114 (e.g., such that the protrusion 105 rotates within the dimple 120). In another example, a substantially spherical protrusion 105 may be captured within the first end cap 124 such that the substantially spherical protrusion 105 is fixed relative to (or non-rotatably coupled to) the first end cap 124 (e.g., via a press-fit, an adhesive coupling, and/or the like). Such a configuration allows the cleaning roller 104 and substantially spherical protrusion 105 to rotate relative to the plate member 114. In yet another example, a substantially spherical protrusion 105 may be captured within the plate member 114 and be configured to rotate relative to the plate member 114 or the cleaning roller 104 (e.g., the first end cap 124). Such a configuration allows the cleaning roller 104 to rotate relative to the plate member

114. In yet another example, a substantially spherical protrusion 105 may be captured within the first end cap 124, wherein a spring biases the substantially spherical protrusion 105 in a direction of the plate member 114. Such a configuration may allow for easier and/or more reliable insertion of the substantially spherical protrusion 105 into the dimple 120. In view of these examples, in some instances, the protrusion 105 may generally be described as providing both a retention function and a bearing function.

[0035] The plate member 114 may be configured to cooperate with the second roller coupling region 112 to retain the cleaning roller 104 within the main body 102. For example, when the protrusion 105 is configured to be self-centering within the dimple 120, a rotational axis 125 (FIG. 1A) of the cleaning roller 104 may be encouraged to remain substantially parallel to flooring to be cleaned during use without the inclusion of additional coupling features (e.g., a sole plate).

[0036] FIGS. 1E-1H illustrate an example embodiment of the second end portion 104B of the cleaning roller 104 and the second roller coupling region 112 of the main body 102. The second end portion 104B is configured to removably couple with the second roller coupling region 112. For example, the second end portion 104B may include an opening 138 (e.g., a tapered opening) configured to receive at least a portion of a coupling hub 150 (e.g., a tapered coupling hub) such that the opening 138 mates with the coupling hub 150 (e.g., such that a rotational movement of the coupling hub 150 is transferred to the cleaning roller 104).

[0037] As shown in FIG. 1E, the second end portion 104B of the cleaning roller 104 includes a second end cap 134 affixed to the end of the second end portion 104B. As shown in the end view of FIG. 1F, the second end cap 134 includes a central engagement region 136. The central engagement region 136 generally defines the opening 138 formed by sidewalls 140A, 140B, 140C and 140D. Sidewalls 140A and 140B are generally opposite to one another, and sidewalls 140C and 140D are generally opposite to one another, thus forming the opening 138 having a generally square cross-section. The sidewalls 140A, 140B, 140C and 140D are generally tapered from the first end 142 of the opening 138 to the second end 144 of the opening 138. Thus, the opening 138 is wider at the first end 142 compared to the second end 144. The perspective view of FIG. 1G illustrates sidewalls 140A and 140D of the second end cap 134.

[0038] FIG. 1H illustrates a cross-sectional view of the second end portion 104B of the cleaning roller 104 and the second roller coupling region 112 of the main body 102. As illustrated in this figure, the second roller coupling region 112 includes the coupling hub 150 having a tapered

portion 152 generally dimensioned to cooperate with the tapered opening 138 (FIGS. 1F and 1G) of the second end cap 134. The coupling hub 150 may be coupled to a rotating member (e.g., gears/belts, etc.) of a main motor (not shown) housed with the main body 102 of the cleaning head 100, so that the coupling hub 150 is driven to controllably rotate thus causing the cleaning roller 104 to rotate.

[0039] The tapered opening 138 may be further configured to encourage a self-centering of the protrusion 105 within the dimple 120 of the plate member 114. For example, the tapered opening 138, when engaging the coupling hub 150, may be configured such that a force is exerted along an axis (e.g., the rotational axis 125) of the cleaner roller 104 that encourages the self-centering of the protrusion 105 within the dimple 120.

[0040] To install the cleaner roller 104 into the main body 102 of the cleaning head 100, the tapered opening 138 of the second end cap 134 of the second end portion 104B of the cleaning roller 104 is inserted into the coupling hub 150 of the second roller coupling region 112. The tapers of the tapered opening 138 and the coupling hub 150 permit the cleaner roller 104 to be first inserted at an “angle”, thus preventing damage to the coupling hub 150 and/or the second end cap 134. Then, the first end portion 104A of the cleaning roller 104 is “snap-fit” into the dimple 120 by pushing the cleaning roller 104 into the cleaning head 100 and causing momentary flexing of the resiliently deformable section 118 of the plate member 114 until the bearing or protrusion 105 “snaps” into the dimple 120. To remove the cleaning roller 104 from the cleaning head 100, the first end portion 104A of the cleaning roller 104 is pulled away from the main body 102 of the cleaning head 100, such that the bearing or protrusion 105 causes flexing of the resiliently deformable section 118 of the plate member 114 until the cleaning roller 104 is clear from the plate member 114.

[0041] As is illustrated, the internal structure of the main body 102 of the cleaning head 100 includes various slots, channels and/or chambers to affix and/or house the cleaning roller 104, plate member 114, etc., within the main body 102. Of course, such slots, channels and/or chambers to affix and/or house components within the main body 102 may be modified, for example, depending on dimensions of selected components, desired tolerances within the body and between components, etc.

[0042] FIGS. 2A and 2B illustrate another embodiment of a cleaning head 200. In this embodiment, the cleaning head 200 includes a main body 202. A plate member 214 is rotatably

coupled to the main body 202 at a first roller coupling region 203 such that the plate member 214 rotates in response to insertion or removal of the main roller 204. The plate member 214 is configured to rotate between a first and a second position (e.g., a position of removal or insertion and a position of use).

[0043] The plate member 214 includes a first region 218 having a dimple 220 and a second region 222 having a tab portion 224. The first region 218 may extend transverse to (e.g., at a perpendicular or non-perpendicular angle) the second region 222. The main body 202 can include an indent 260 to receive the tab portion 224 and a receptacle 261 to receive at least a portion of a convex portion of the dimple 220. The receptacle 261 may be at least partially defined by one or more sidewalls 263. The one or more sidewalls 263 may be configured to engage with a portion of the first region 218 of the plate member 214. Such a configuration may be configured to limit rotational movement of the plate member 214 towards the receptacle 261 when the main roller 204 is being inserted into the main body 202.

[0044] The main body 202 includes an indent 260 to receive the tab portion 224. The tab portion 224 rotates within the indent 260 upon insertion and removal of a main roller 204. The main roller 204 includes protrusion 205 generally dimensioned to mate with the dimple 220, as described above with reference to FIGS. 1A-1D.

[0045] In FIG. 2A, the main roller 204 is in a position of removal or insertion. When the main roller 204 is being inserted, the first region 218 of the plate member 214 is rotated towards the main body 202 (e.g., such that at least a portion of the convex portion of the dimple 220 is moved into the receptacle 261). When the main roller 204 is being removed, the first region 218 of the plate member 214 is rotated away from the main body 202 (e.g., such that at least a portion of the convex portion of the dimple 220 is moved out of the receptacle 261). After the main roller 204 has been removed, the plate member 214 may remain in the position of removal or insertion (e.g., the plate member 214 may include a retention feature and/or a spring to retain the plate member 214 in the position of removal or insertion).

[0046] FIG. 2B illustrates the main roller 204 fully inserted into the main body 202, there the protrusion 205 is engaged within the dimple 220, and the first region 218 of the plate member 214 is rotated into a “locked” position within the main body 202.

[0047] As described above, the cleaning head 100/200 may be coupled to a variety of vacuum systems, depending on the types of cleaning tasks to be performed. Accordingly, FIG. 3 illustrates

an example vacuum cleaning system that may be used with the cleaning head 100/200 of FIGS. 1A-1H and FIGS. 2A-2B. In particular, FIG. 3 illustrates a schematic example of an upright extraction cleaner 300 consistent with embodiments of the present disclosure. The upright extraction cleaner 300 includes a surface cleaning head 100/200, and an upright body 304 including a handle 306. The upright body 304 is pivotally coupled to the surface cleaning head 100/200 such that the upright body 304 transitions between an in-use and a storage position in response to pivotal movement of the upright body 304. A user may interact with the handle 306 to maneuver the surface cleaning head 100/200 along a surface to be cleaned 308. The handle 306 may also include one or more control switches (e.g., buttons, levers, etc.) to engage and disengage a motorized drive assembly associated with the cleaning head 100/200, thus enabling a user to turn the cleaning roller 104 on and off, depending on a given cleaning task.

[0048] FIG. 4 illustrates an example vacuum cleaning system that may be used with the cleaning head 100/200 of FIGS. 1A-1H and FIGS. 2A-2B. In particular, FIG. 4 illustrates a robotic cleaner 400 consistent with embodiments of the present disclosure. The robotic cleaner 400 includes a chassis 402, a plurality of driven wheels 404, one or more sensors 406 (e.g., mapping and/or obstacle detection sensors), a controller 408 communicatively coupled to the one or more sensors 406, the cleaning head 100/200 coupled to (and/or at least partially formed from) the chassis 402, a dust cup 410, and a suction motor 412 configured to draw air into the cleaning head 100/200 and through the dust cup 410. In use, air drawn into the cleaning head 100/200 may include debris entrained therein, wherein at least a portion of the entrained debris is deposited in the dust cup 410 for later disposal.

[0049] Accordingly, one embodiment of the present disclosure provides a cleaning head for a vacuum system. The cleaning head includes a main body. The main body includes a first roller coupling region and a second roller coupling region. The first roller coupling region and the second roller coupling region being generally disposed at opposite ends of the main body and at either end of a vacuum orifice defined in the main body. The first roller coupling region includes a plate member having a resiliently deformable section and a dimple defined in the resiliently deformable section. The cleaning head also includes a cleaning roller having a first end portion and a second end portion, the second end portion being removably coupled to the second roller coupling region and the first end portion being removably coupled to the first roller coupling region. The cleaning roller having a protrusion on the first end portion to be received in the dimple.

[0050] In another embodiment, the present disclosure provides cleaning head for a vacuum system that includes a main body; a first roller coupling region and a second roller coupling region; the first roller coupling region and the second roller coupling region being generally disposed at opposite ends of the main body and at either end of a vacuum orifice defined in the main body; the first roller coupling region including a plate member pivotally coupled to the main body and a dimple; and a cleaning roller having a first end portion and a second end portion, the second end portion being removably coupled to the second roller coupling region and the first end portion being removably coupled to the first roller coupling region; the cleaning roller having a protrusion on the first end portion to be received in the dimple.

[0051] In another embodiment, the present disclosure provides a method to couple a cleaning roller to a cleaning head; the cleaning roller having a first end portion, a second end portion and protrusion formed on the first end portion; the cleaning head having a first roller coupling region and a second roller coupling region, the first roller coupling region having a plate member and a dimple formed in a resiliently deformable section of the plate member; the method comprising: inserting the second end portion of the cleaning roller into a second roller coupling region of the cleaning head; inserting the first end portion of the cleaning roller into the first roller coupling region; and deforming the resiliently deformable section of the plate member until the protrusion snaps into the dimple.

[0052] In another embodiment, the present disclosure provides a method to decouple a cleaning roller from a cleaning head; the cleaning roller having a first end portion, a second end portion and protrusion formed on the first end portion; the cleaning head having a first roller coupling region and a second roller coupling region, the first roller coupling region having a plate member and a dimple formed in a resiliently deformable section of the plate member; the method comprising: pulling the first end portion of the cleaning roller away from the first roller coupling region of the main body of the cleaning head; flexing the resiliently flexible section of the plate member by the protrusion until the protrusion is clear of the plate member; and removing the second end portion of the cleaning roller from the second roller coupling region of the main body of the cleaning head.

[0053] As used in this application and in the claims, a list of items joined by the term “and/or” can mean any combination of the listed items. For example, the phrase “A, B and/or C” can mean A; B; C; A and B; A and C; B and C; or A, B and C. As used in this application and in the claims, a list of items joined by the term “at least one of” can mean any combination of the listed terms. For

example, the phrases “at least one of A, B or C” can mean A; B; C; A and B; A and C; B and C; or A, B and C.

[0054] The terms and expressions which have been employed herein are used as terms of description and not of limitation, and there is no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described (or portions thereof), and it is recognized that various modifications are possible within the scope of the claims. Accordingly, the claims are intended to cover all such equivalents. Various features, aspects, and embodiments have been described herein. The features, aspects, and embodiments are susceptible to combination with one another as well as to variation and modification, as will be understood by those having skill in the art. The present disclosure should, therefore, be considered to encompass such combinations, variations, and modifications.

[0055] Reference throughout this specification to “one embodiment” or “an embodiment” means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment. Thus, appearances of the phrases “in one embodiment” or “in an embodiment” in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments.

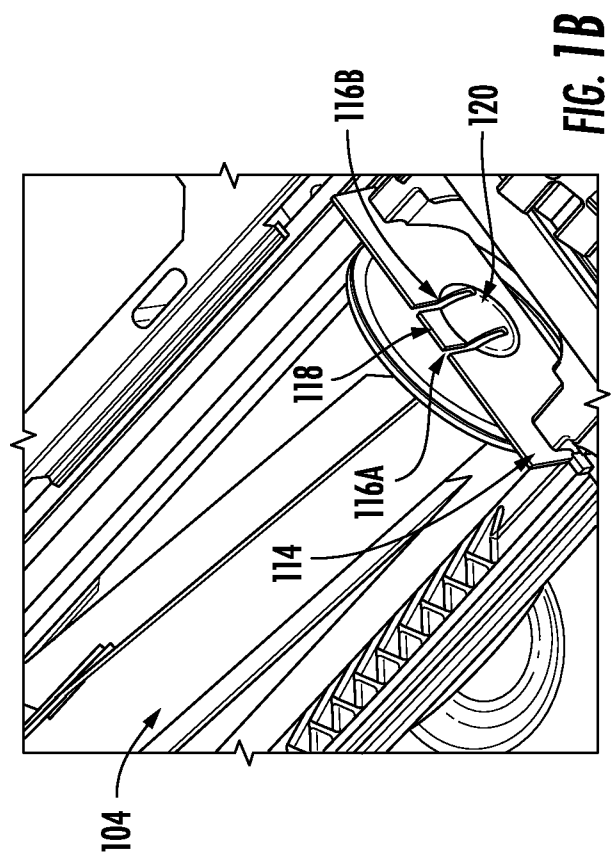
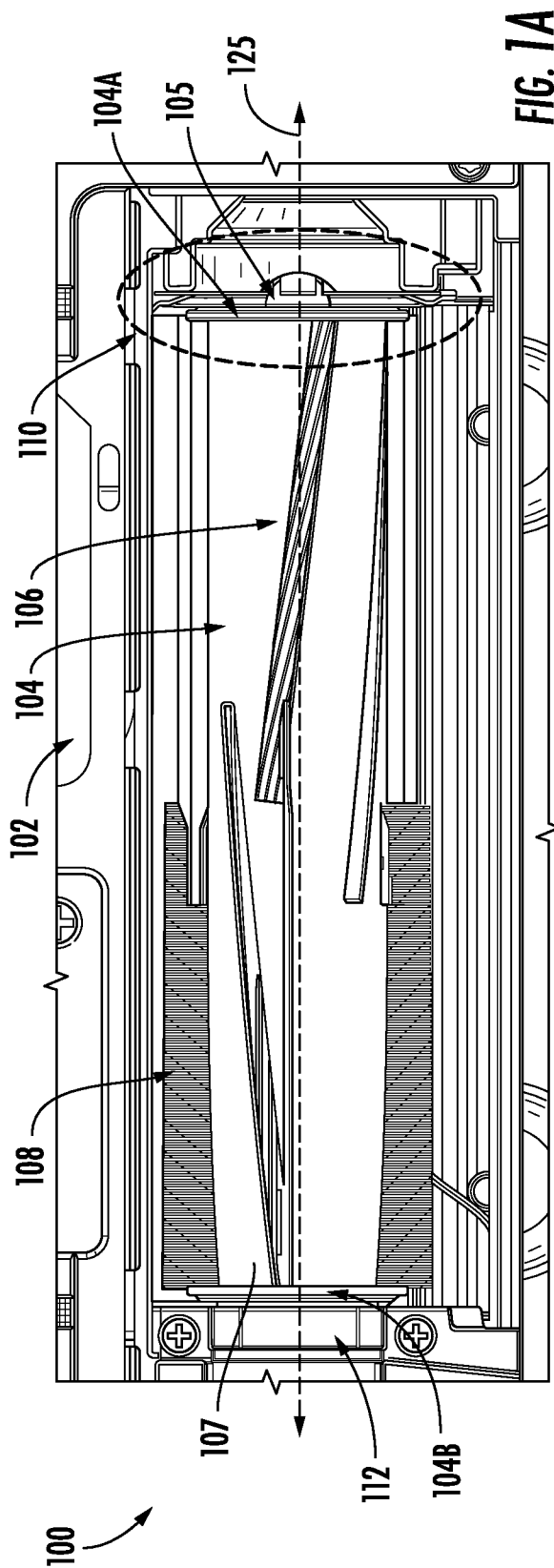
[0056] While the principles of the invention have been described herein, it is to be understood by those skilled in the art that this description is made only by way of example and not as a limitation as to the scope of the invention. Other embodiments are contemplated within the scope of the present invention in addition to the exemplary embodiments shown and described herein. Modifications and substitutions by one of ordinary skill in the art are considered to be within the scope of the present invention, which is not to be limited except by the following claims.

What is claimed is:

1. A cleaning head for a vacuum system, comprising:
a main body;
a first roller coupling region and a second roller coupling region, the first roller coupling region and the second roller coupling region being generally disposed at opposite ends of the main body and at either end of a vacuum orifice defined in the main body, the first roller coupling region including a plate member having a resiliently deformable section and a dimple defined in the resiliently deformable section; and
a cleaning roller having a first end portion and a second end portion, the second end portion being removably coupled to the second roller coupling region and the first end portion being removably coupled to the first roller coupling region, the cleaning roller having a protrusion on the first end portion to be received in the dimple.
2. The cleaning head of claim 1, wherein the plate member includes first and second seams to define the resiliently deformable section and to provide resilient flexibility to the resiliently deformable section.
3. The cleaning head of claim 1, wherein the dimple has a continuously concave cross-section.
4. The cleaning head of claim 1, wherein the protrusion has a continuously convex cross-section.
5. The cleaning head of claim 1, wherein the cleaning roller is removably disposed within the vacuum orifice.
6. The cleaning head of claim 1, wherein the cleaning roller includes at least one bristle track.
7. The cleaning head of claim 1, wherein the plate member is formed from metal, plastic, and/or composite materials.

8. The cleaning head of claim 1, wherein:
 - the second roller coupling region includes a coupling hub having a tapered portion;
 - and
 - the second end portion of the cleaning roller includes an end cap defining a tapered opening, the tapered opening of the second end portion of the cleaning roller mating with the tapered portion of the coupling hub.
9. The cleaning head of claim 1, wherein the cleaning roller includes an end cap that rotates with the cleaning roller and the protrusion is coupled to the end cap.
10. The cleaning head of claim 9, wherein the protrusion is non-rotatably coupled to the end cap.
11. The cleaning head of claim 10, wherein at least a portion of the protrusion includes substantially spherical shape.
12. The cleaning head of claim 11, wherein the protrusion is a ball bearing press-fit into the end cap.
13. A cleaning head for a vacuum system, comprising:
 - a main body;
 - a first roller coupling region and a second roller coupling region, the first roller coupling region and the second roller coupling region being generally disposed at opposite ends of the main body and at either end of a vacuum orifice defined in the main body, the first roller coupling region including a plate member pivotally coupled to the main body and a dimple; and
 - a cleaning roller having a first end portion and a second end portion, the second end portion being removably coupled to the second roller coupling region and the first end portion being removably coupled to the first roller coupling region, the cleaning roller having a protrusion on the first end portion to be received in the dimple.

14. The cleaning head of claim 13, wherein the plate member is configured to pivot between a first position when the cleaning roller is removed from the main body and a second position when the cleaning roller is inserted into the main body.
15. The cleaning head of claim 13, wherein the dimple has a continuously concave cross-section.
16. The cleaning head of claim 13, wherein the protrusion has a continuously convex cross-section.
17. The cleaning head of claim 13, wherein the cleaning roller is removably disposed within the vacuum orifice.
18. The cleaning head of claim 13, wherein the cleaning roller includes at least one bristle track.
19. The cleaning head of claim 13, wherein the plate member is formed from metal, plastic, and/or composite materials.
20. The cleaning head of claim 13, wherein:
 - the second roller coupling region includes a coupling hub having a tapered portion;
 - and
 - the second end portion of the cleaning roller having an end cap defining a tapered opening, the tapered opening of the second end portion of the cleaning roller mating with the tapered portion of the coupling hub.



2/10

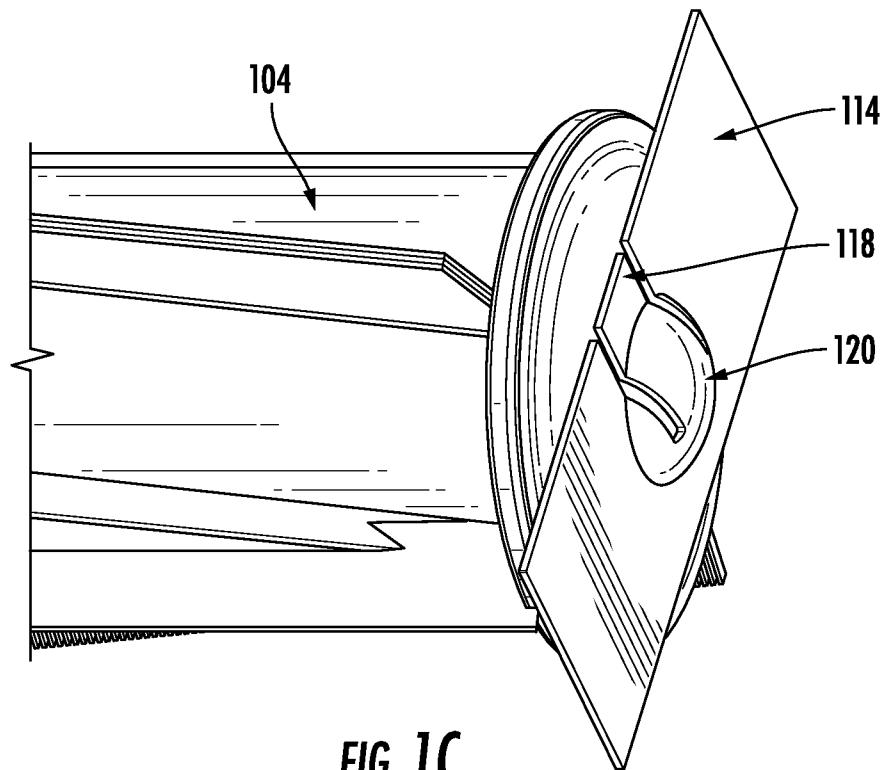


FIG. 1C

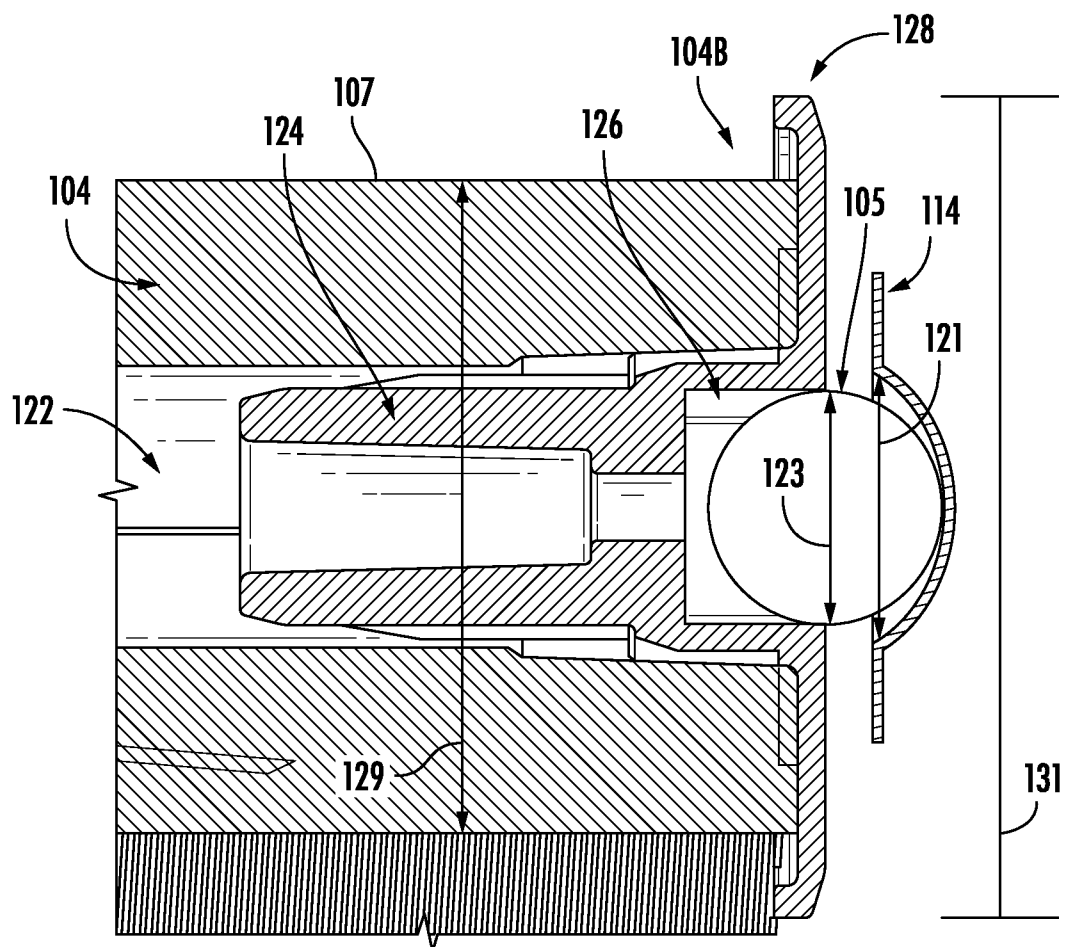


FIG. 1D

3/10

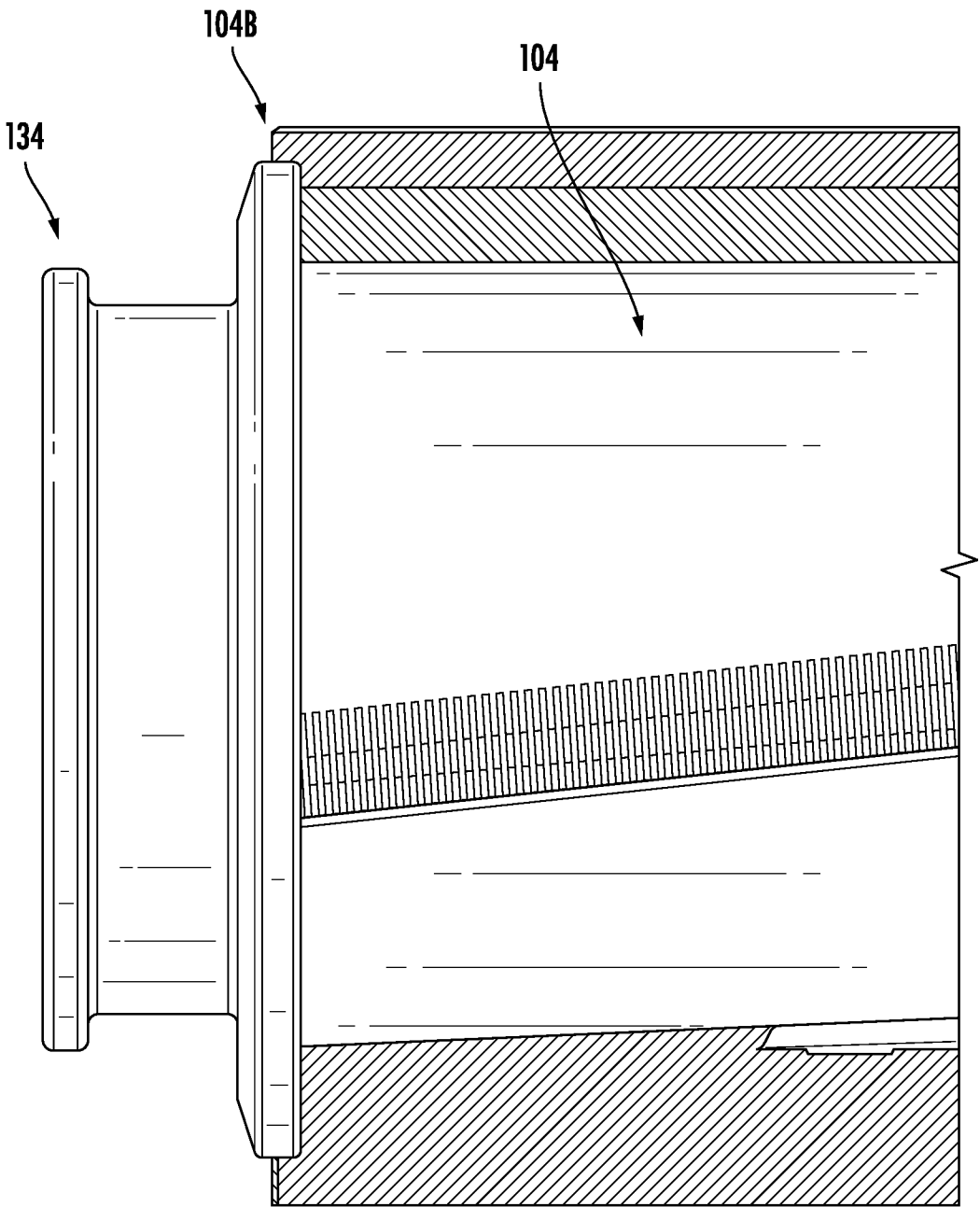


FIG. 1E

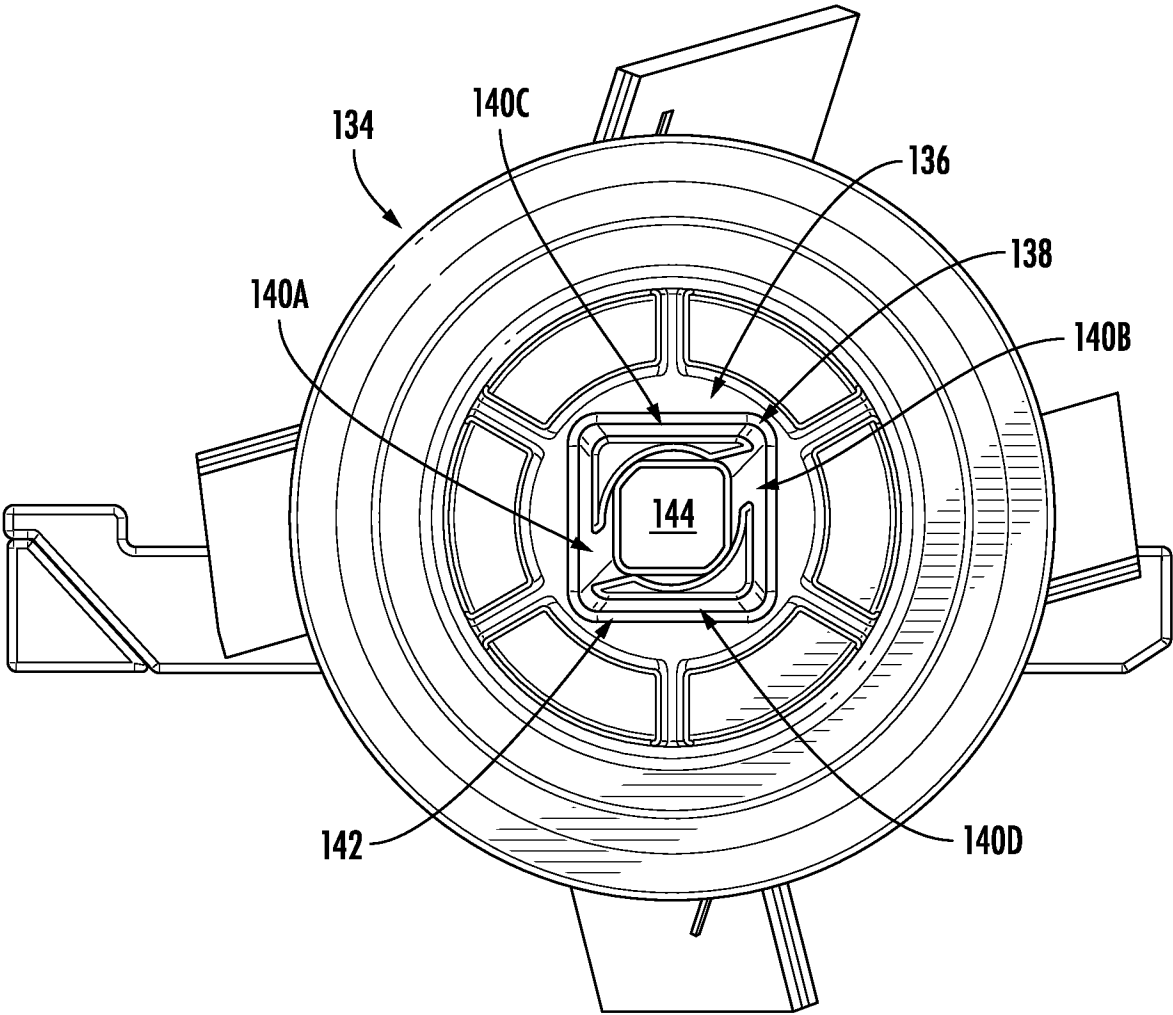


FIG. 1F

5/10

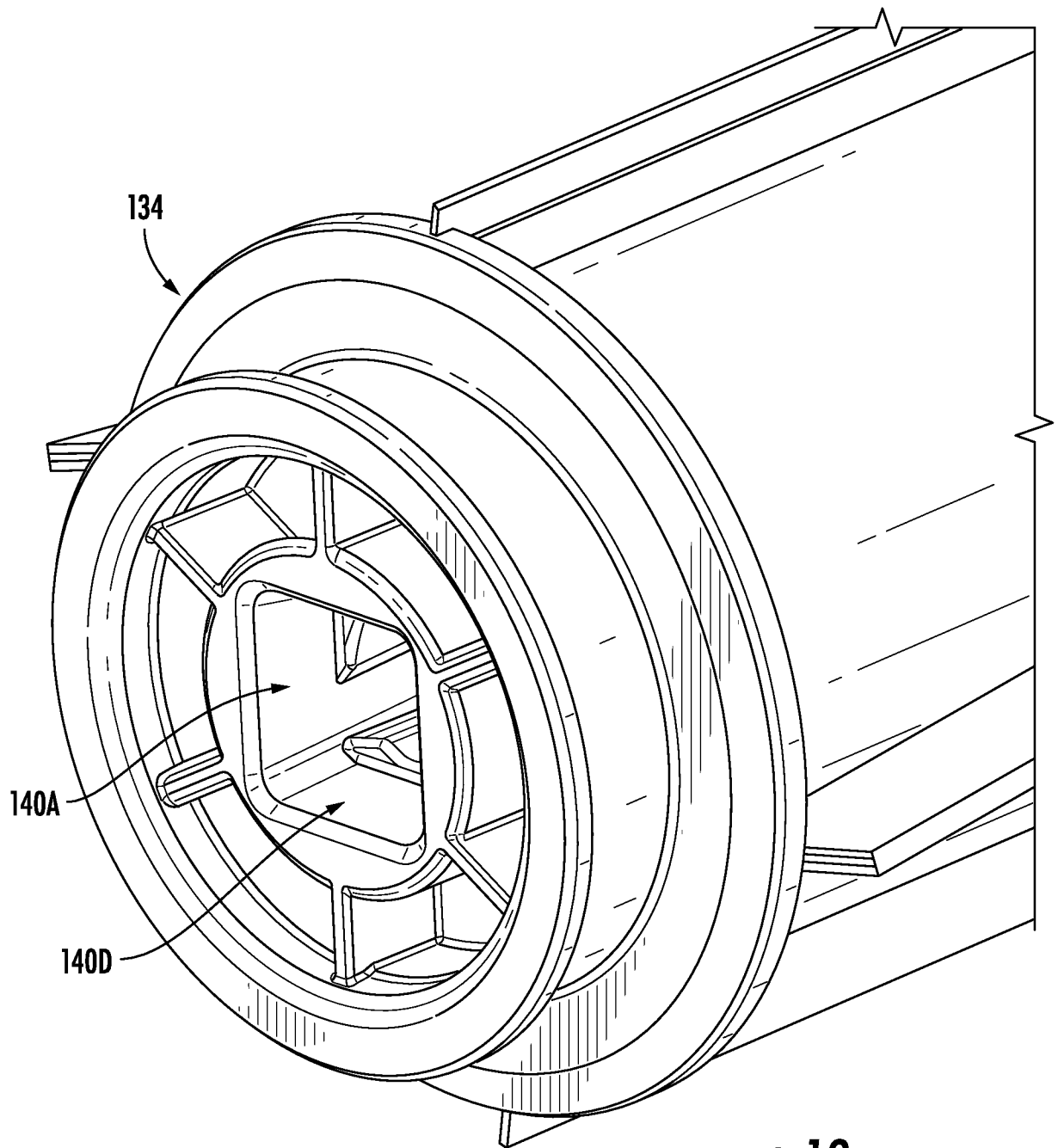


FIG. 1G

6/10

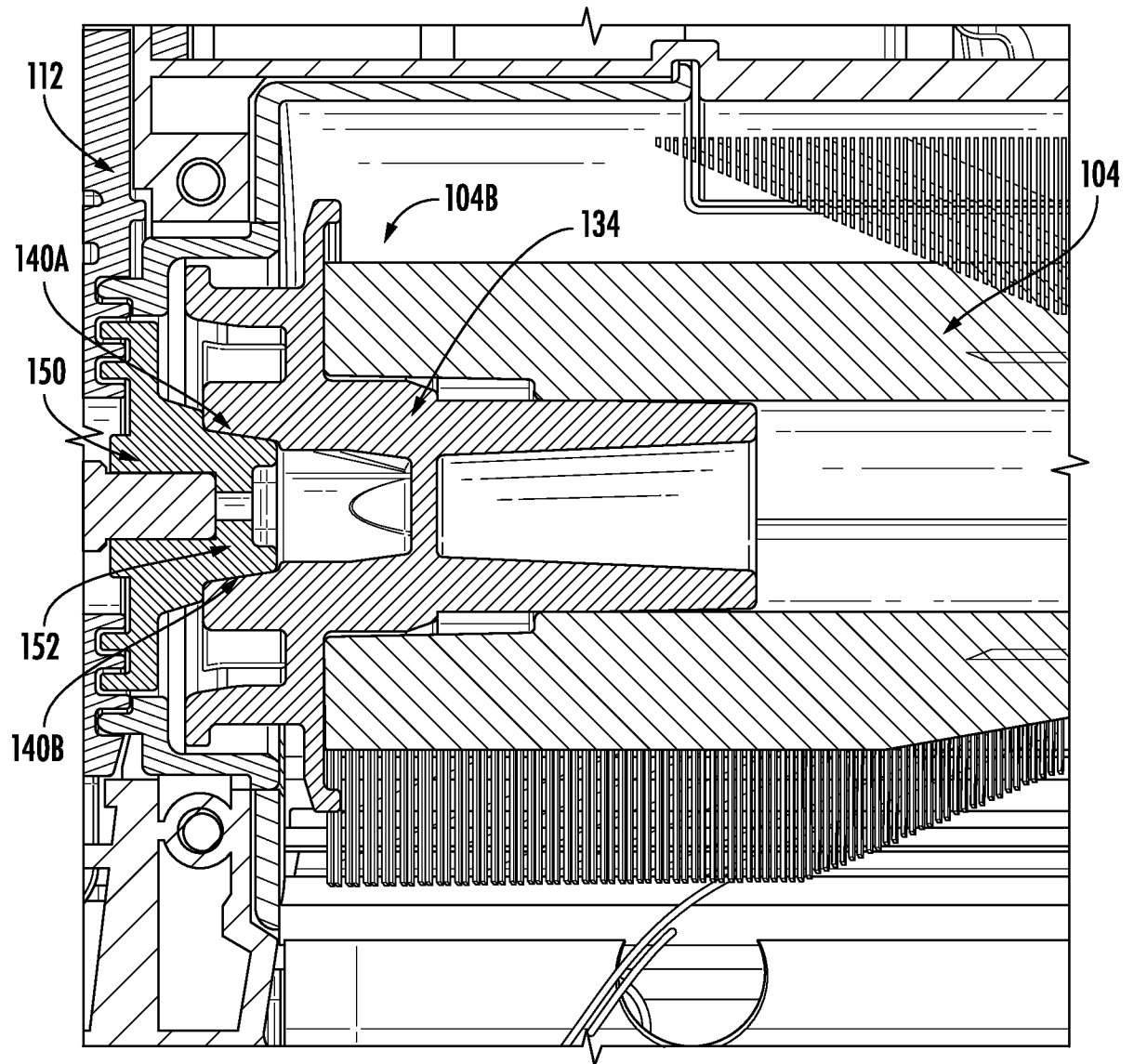


FIG. 1H

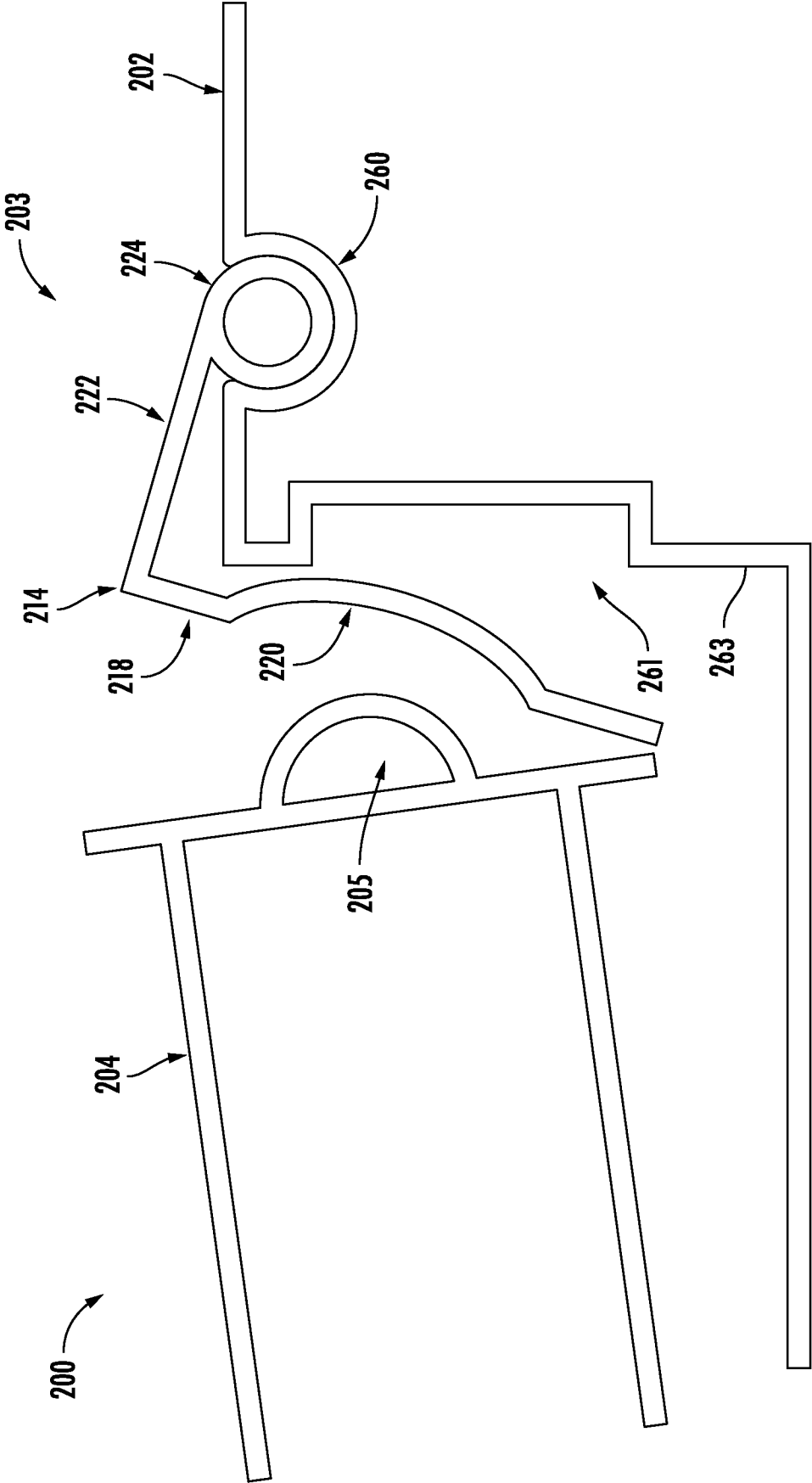


FIG. 2A

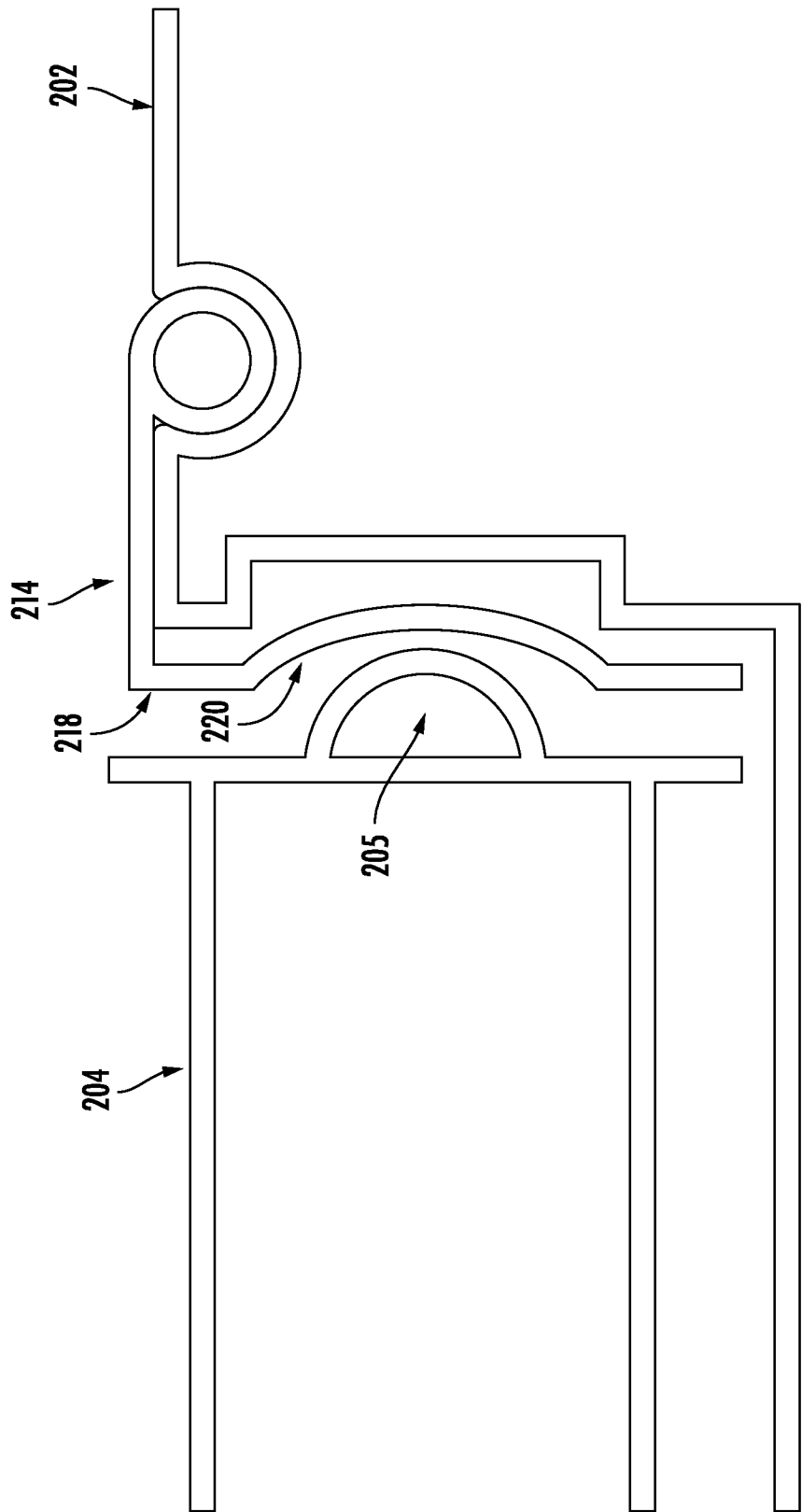


FIG. 2B

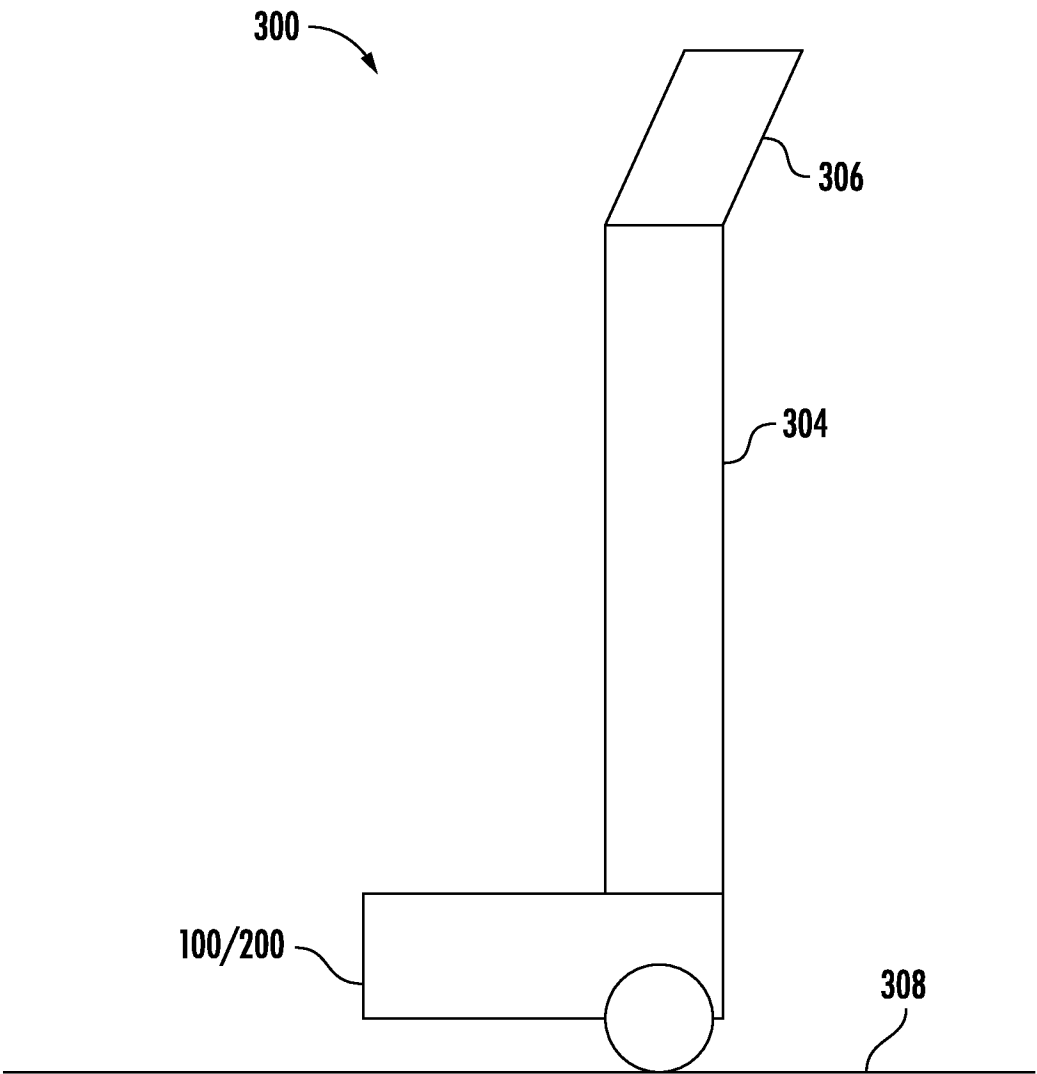
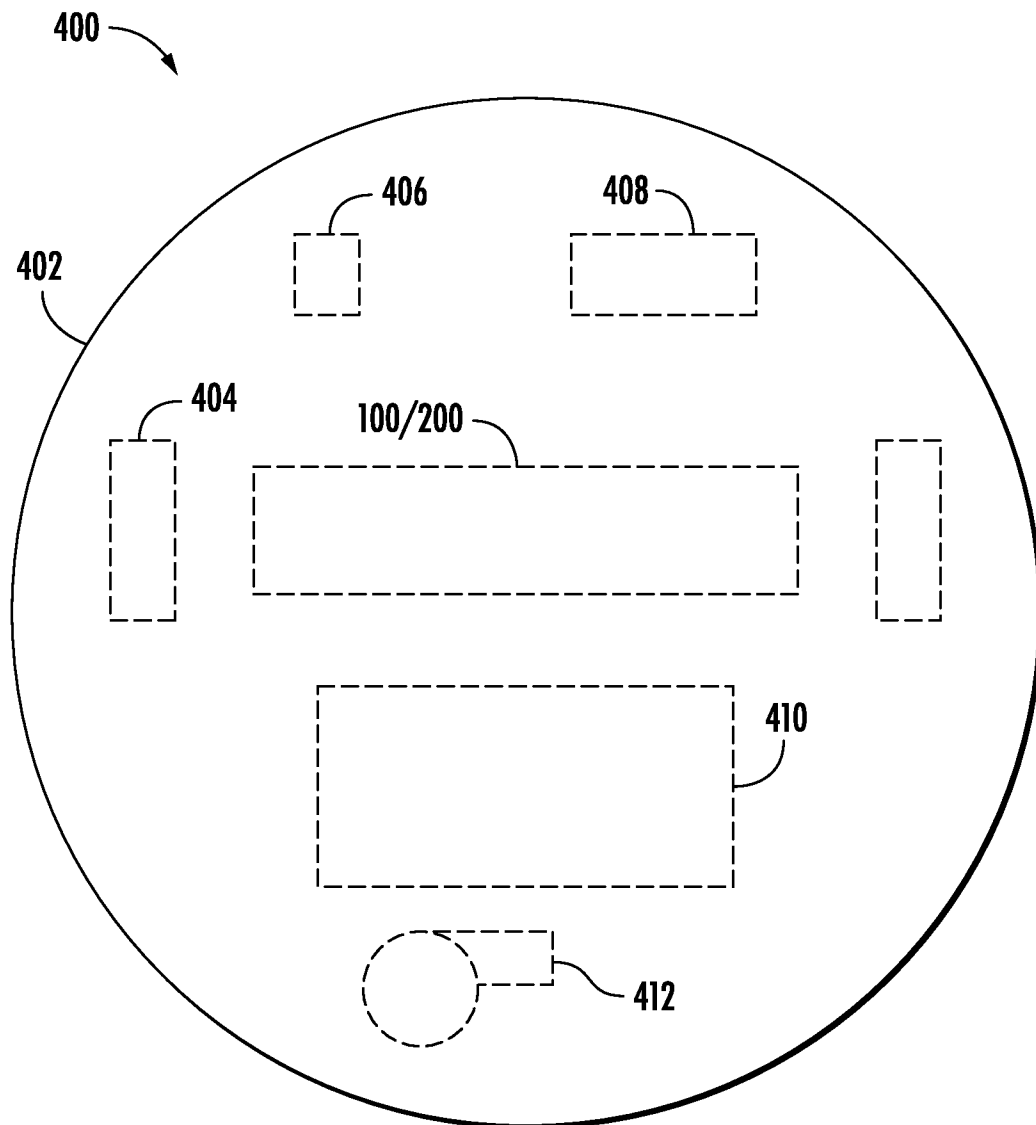


FIG. 3

10/10

**FIG. 4**

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2024/051714

A. CLASSIFICATION OF SUBJECT MATTER

IPC: **A47L 11/24** (2024.01); **A47L 9/04** (2024.01); **A47L 9/06** (2024.01); **A47L 11/40** (2024.01); A47L 9/12 (2024.01)
CPC: **A47L11/24**; **A47L9/0455**; **A47L9/0477**; **A47L11/4041**; A47L9/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

See Search History Document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

See Search History Document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

See Search History Document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 111387877 A (SHANGHAI GAUSSIAN AUTOMATION TECH. DEVELOPMENT CO. LTD.) 10 July 2020 (10.07.2020) Figs. 4, 5, English Machine Translation: paras. [0079], [0081]	1-20
Y	CN 205758455 U (SHENZHEN ZHIYI TECH CO LTD) 07 December 2016 (07.12.2016) Fig. 8, English Machine Translation: para. [0035]	1-20
Y A	CN 208598293 U (KINGSUN CLEANING EQUIPMENT SUZHOU CO LTD) 15 March 2019 (15.03.2019) Figs. 8-10, English Machine Translation: paras. [0039], [0042]	1-12 13-20
Y A	US 2012/0159725 A1 (KAPOOR DEEPAK ET AL.) 28 June 2012 (28.06.2012) Figs. 5 and 6; paras. [0052]-[0054]	8, 12, 20 1-7, 9-11, 13-19



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance
“D” document cited by the applicant in the international application
“E” earlier application or patent but published on or after the international filing date
“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
“O” document referring to an oral disclosure, use, exhibition or other means
“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

02 January 2025 (02.01.2025)

Date of mailing of the international search report

17 January 2025 (17.01.2025)

Name and mailing address of the ISA/US

COMMISSIONER FOR PATENTS
MAIL STOP PCT, ATTN: ISA/US
P.O. Box 1450
Alexandria, VA 22313-1450
UNITED STATES OF AMERICA

Authorized officer

SHANE THOMAS

Facsimile No. 571-273-8300

Telephone No. PCT Helpdesk: (571) 272-4300