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(71) Applicant: **SharkNinja Operating LLC**
Needham, MA 02494 (US)

(72) Inventors:
- **VRDOLJAK, Ognjen**
Laval, H7W 1Y3 (CA)
- **Innes, Dan**
Newton, 02459 (US)

(74) Representative: **Barker Brettell LLP**
100 Hagley Road
Edgbaston
Birmingham B16 8QQ (GB)

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(54) SURFACE TREATEMENT APPARATUSES AND METHODS

(57) Methods and apparatuses for surface treatment may comprise a mop head (9100), comprising a frame (9102) including flaps (9104) pivotably connected to the frame (9104) so as to rotate relative to the frame between an open position and a closed position; a connector assembly pivotably connected to the frame and comprising an upper portion, a lower portion, and a joint configured to allow the upper portion and the lower portion to rotate relative to each other; and a locking mechanism (9164) configured to releasably secure the flaps in the closed position and including a trigger (9173) configured to release the flaps from the closed position, when actuated.

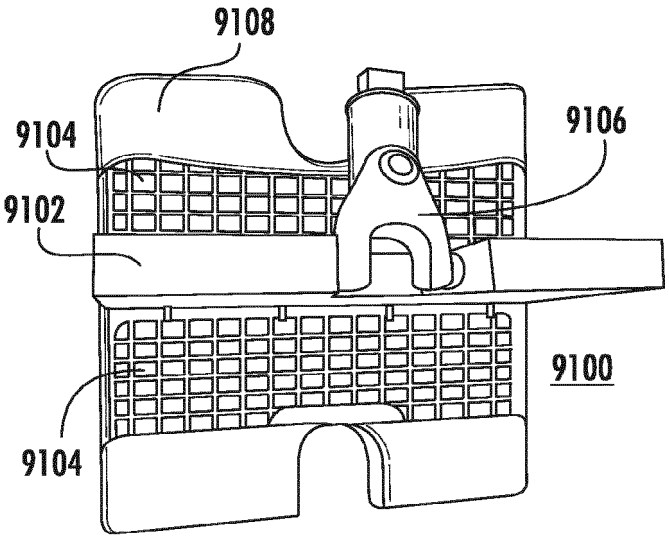

FIG. 9

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Description

CROSS REFERENCE TO RELATED PATENT APPLICATIONS

[0001] This disclosure claims priority to U.S. Provisional Patent Application Nos.: 62245195, entitled "Surface Treatment Apparatus with a Steam Change-Over Device" filed October 22, 2015; 62166636, entitled "Surface Treatment Apparatus with Releasable Flaps" filed May 26, 2015, herein incorporated by reference.

TECHNICAL FIELD

[0002] This disclosure relates to surface treatment apparatuses and methods.

BACKGROUND

[0003] Surface treatment appliances are used in the home, office and other locations to treat floors and other surfaces. Various types of surface treatment appliances, such as appliances with oscillating and/or rotating brushes, are known for cleaning carpets. Additionally, certain types of surface treatment appliances, such as non-steam mops, spray appliances with padded configurations, or steam mops with steam cleaning head, may be used for cleaning and treating floors.

SUMMARY

[0004] Methods and apparatuses for surface treatment according to various aspects of the present invention may be used for various functions such as non-steam or steam cleaning or treatment, non-steam or steam cleaning and treatment, and may comprise a body, a mop head, and a connector assembly connecting the body and the mop head, wherein the mop head may be configured to rotate about a transverse axis of rotation relative to the connector assembly.

[0005] In various aspects of the present invention, the methods and apparatuses for surface treatment may comprise a connector assembly which may be configured to allow for swapping the body with various embodiments of bodies so as to allow for a variety of mop head and body assemblies, thereby allowing various non-steam or steam cleaning and/or treatment operations.

[0006] In an embodiment of the present disclosure, the methods and apparatuses for surface treatment when used for steam cleaning operations may comprise a steam source, a mop head connected to the steam source through the connector assembly. The connector assembly may be configured to comprise a universal joint, or a combination of a universal joint and a connector housing wherein the connector housing may define a steam passageway.

[0007] In an embodiment, the mop head may comprise a first and second opposing surfaces, wherein both the first and the second opposing surfaces may be configured to output steam or only either the first or the second opposing surfaces may be configured to output steam. In an embodiment, the mop head may comprise a change-over device or a mechanism to direct the steam flow only to the first opposing surface when the second opposing surface is facing upwardly, and only to the second opposing surface when the first opposing surface is facing upwardly.

[0008] In an embodiment, the connector assembly may comprise a connector steam inlet, a connector steam conduit, a steam blast nozzle assembly, and/or a mechanism that may allow steam to be output either through the steam blast nozzle assembly, indicating a steam blast mode of operation or through one of the first or second surfaces of the mop head, indicating a normal area cleaning mode of operation. The normal area cleaning mode and steam blast modes of operation may be determined by the position of the mop head relative to the connector assembly, wherein the position of the mop head may be determined by the angle between the mop head and the connector assembly.

[0009] In an embodiment, the mop head may be a flippable type of mop head wherein the mop head may be turned by 180° angle from a first position to a second position such that in a first position of the mop head, the first opposing surface of the mop head may be facing upwardly and in a second position of the mop head, the second opposing surface of the mop head may be facing upwardly.

[0010] In an embodiment, the mop head may be rotated by 180° from one position to the other such that in all positions of the mop head, only either the first or the second opposing surfaces may be facing upwardly but not both. In such an embodiment, the steam blast mode of operation may be accompanied by a scrubbing action. The scrubbing action may be brought about by providing a deployable scrubber assembly which may engage with the area to be cleaned when in steam blast mode of operation and may disengage with the area when in normal area cleaning mode of operation.

[0011] In an embodiment, the mop head of the present disclosure may include a frame, flaps releasably connected to a first side of the frame, and a joint pivotably connected to a second side of the frame, the first and second sides opposing each other. A first side of each flap may be pivotably connected to the first side of the frame along hinge axes that are spaced apart. In an embodiment, a second side of each flap comprises at least one protruding portions configured to be received in a cavity defined in a pad interior surface. In an embodiment, each flap is configured to be removably attached to an interior surface of a pad.

[0012] In another embodiment, the mop head of the present disclosure may include a frame, flaps releasably connected to a first side of the frame, an attachment bar pivotably connected to a second side of the frame, the first and second sides opposing each other, and a joint

pivotably connected to the attachment bar. A first side of each flap may be pivotably connected to the first side of the frame along hinge axes that are spaced apart. In an embodiment, a second side of each flap comprises at least one protruding portion configured to be received in a cavity defined in a pad interior surface. In an embodiment, each flap is configured to be removably attached to an interior surface of a pad.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

Figures 1A-E are illustrations of various exemplary components of an exemplary surface treatment apparatus and their assembly, in accordance with the present disclosure;

Figures 2A-C are illustrations and schematic diagrams illustrating an exemplary embodiment of a surface treatment apparatus employed in steam cleaning operations comprising an exemplary embodiment of a change-over device, in accordance with the present disclosure;

Figures 3A-D are illustrations of exemplary embodiments of a mop head of a surface treatment apparatus employed in steam cleaning operations comprising another exemplary embodiment of a change-over device in accordance with the present disclosure;

Figures 4A-C are illustrations of exemplary embodiments of an exemplary embodiment of a surface treatment apparatus employed in steam cleaning operations comprising a pivoting steam vent, in accordance with the present disclosure;

Figure 5 is an illustration of an exemplary embodiment of a mop head comprising a steam vent, in accordance with the present disclosure.

Figures 6A-D are illustrations of various exemplary angular orientations of the mop head relative to the connector assembly in an exemplary embodiment of a surface treatment apparatus, in accordance with the present disclosure;

Figures 7A-K are illustrations of exemplary embodiments of a surface treatment apparatus employed in steam cleaning operations, comprising a normal area cleaning mode of operation and a steam blast mode of operation, with or without the presence of a change-over device in the mop head, and wherein both the first and the second opposing surfaces of the mop head may be employed for cleaning, in accordance with the present disclosure.

Figures 8A-P are illustrations of exemplary embodiments of a surface treatment apparatus employed in steam cleaning operations, comprising a normal area cleaning mode of operation and a steam blast mode of operation, with or without the scrubbing functionality, in accordance with the present disclosure.

Figure 9 is an illustration of an exemplary embodiment of a mop head, in accordance with the present disclosure.

Figure 10 is an illustration of an exemplary embodiment of a cleaning pad of the mop head shown in Figure 9, in accordance with the present disclosure.

Figure 11-11d are illustrations of exemplary embodiments of the flap of the mop head as shown in Figure 9 for attachment and detachment of the cleaning pad as shown in Figure 10, in accordance with the present disclosure.

Figure 12-12h are illustrations and schematic diagrams illustrating exemplary embodiments of the flap-release mechanisms of the mop head shown in Figure 9, in accordance with the present disclosure.

Figure 13-13e are illustrations and schematic diagrams illustrating an exemplary embodiment of a flap-release mechanism mop head shown in Figure 9, in accordance with the present disclosure.

Figure 14 is an illustration of a swiveling yoke assembly of the mop head shown in Figure 9, in accordance with the present disclosure.

Figures 15-15h are illustrations and schematic diagrams illustrating one embodiment of the release mechanism.

Figure 16 illustrates one embodiment of the apparatus comprising a linkage element and flap ejectors.

Figure 17 illustrates a front view of a surface treatment system having (i) a steam application device equipped with a swivel to provide enhanced maneuverability, and (ii) a portable steam source.

DETAILED DESCRIPTION

[0014] It will be appreciated by those of ordinary skill in the art that the embodiments disclosed herein can be embodied in other specific forms without departing from the spirit or essential character thereof. The presently disclosed embodiments are therefore considered in all respects to be illustrative and not restrictive.

[0015] Example embodiments will now be described hereinafter with reference to the accompanying drawings, which form a part hereof, and which illustrate example embodiments which may be practiced. Such embodiments may be realized by any number of components configured to perform the specified functions and achieve the various results. For example, the present invention may employ various types of surface treatment apparatuses, which may carry out a variety of functions. In addition, the present invention may be practiced in conjunction with any number of cleaning or treatment processes. As used in the disclosures and the appended claims, the terms "embodiment", "example embodiment", and "exemplary embodiment" do not necessarily refer to a single embodiment, although they may, and various example embodiments may be readily combined and interchanged, without departing from the scope or spirit of example embodiments. Furthermore, the termi-

nology as used herein is for the purpose of describing example embodiments only and is not intended to be limitations. In this respect, as used herein, the term "in" may include "in" and "on", and the terms "a," "an" and "the" may include singular and plural references. Furthermore, as used herein, the term "by" may also mean "from", depending on the context. Furthermore, as used herein, the term "if" may also mean "when" or "upon," depending on the context. Furthermore, as used herein, the words "and/or" may refer to and encompass any and all possible combinations of one or more of the associated listed items.

[0016] Various kinds of apparatuses such as non-steam mops or steam mops may be used for cleaning and treating surfaces. Many non-steam mops may include various combinations of handle, shaft, and a cleaning head. Likewise, many steam mops may include various combinations of handle, shaft, water storage tank, heating element and cleaning head. A variety of cleaning pads may be attached to the cleaning head. And the combination of the cleaning pad and the cleaning head allow for contact with the surface that user is cleaning or treating.

[0017] Figures 1A-E illustrate an exemplary embodiment of a surface treatment system 1000 and its various components that may be used in non-steam or steam cleaning or otherwise treating a surface, such as wood or laminate flooring. It should be appreciated that the surface treatment system 100 described herein may be used in a variety of operations to perform one or more cleaning or treatment functions. The surface treatment system 1000 may comprise a body 200, a connector assembly 300, and a mop head 400 (Fig. 1A). As illustrated in Figs. 1B-1E, the surface treatment system 100 may be assembled to comprise various combinations of the body 200, the connector assembly 300, and mop head 400. The body 200 may comprise various combinations of structural elements, such as a shaft 210, a handle 220, and/or a steam source 240 and/or a housing 230 comprising a steam source 240 (Fig. 1B).

[0018] The connector assembly 300 may comprise a universal joint 310 (Fig. 1C) which may be configured to releasably and interchangeably connect to various embodiments of bodies 200 disclosed herein. The ability of the universal joint 310 to releasably and interchangeably connect to a plurality of bodies 200 allows the mop head 400 connected to the universal joint 310 to be releasably and interchangeably connected to a plurality of bodies 200 available in the surface treatment system 100, resulting in a variety of combinations that can be assembled to form a surface treatment device/apparatus from the surface treatment system 100. Furthermore, a plurality of the mop heads 400 (Fig. 1D) of the same or different types may be configured to include the same universal joint 310 to allow for more variety of combinations of different mop heads 400 and different bodies 200 to be assembled from the surface treatment system 100.

[0019] In an embodiment (Fig. 1C), a first end of the universal joint 310 may be releasably and interchangeably connected to the body 200, and a second end of the universal joint 310 may be pivotably connected to the mop head 400. The universal joint 310 may be of any type configured to facilitate various combinations of multi-axial rotations (example, side to side, front to back, up and down, movements of the mop head 400 relative to the body 200). In the illustrated embodiment in Fig. 1C, the first end portion of the universal joint 310 connects to the body 200 and the second end portion of the universal joint 310 connects to the mop head 400. The first end portion of the universal joint 310 may comprise an upper connection piece 320 and the second end portion may comprise a lower connection piece 330. The upper connection piece 320 may comprise a proximal end 321 for connection to the body 200 and a distal end 322 for pivotally connecting to a proximal end 331 of the lower connection piece 330. The connection between upper connection piece 320 and lower connection piece 330 may allow for front to back and side to side movement of the body 200 relative to the connector assembly 330. The lower connection piece 330 may further comprise a distal end 336 with a pair of side pivot arms 337, 338 extending laterally there from. The side pivot arms 337, 338 may be pivotally connected to the mop head 400.

[0020] As illustrated in Fig. 1D, the mop head 400 may comprise a mop head of any geometric shape, such as a mop head 410 or a mop head 420. The mop head 410 may comprise a front wall 411, rear wall 412, right side wall 413 and a left wall 414 defining a frame. The mop head 420 may comprise a right side wall 421, a left side wall 422 and a base 423 defining a frame. The frame of the mop head 410 or the mop head 420 may define a connector receiving opening 430 in the rear wall 412 (example, Fig. 1D(1)), or a connector receiving opening 44 in the base 423 (example, Fig. 1D(2)), respectively. The connector receiving opening 430 or 440 may be of any geometric shape. The mop head 410 may include connector receiving slot bushings 431, 432 within the connector receiving opening 430 for receiving the pivot arms 337, 33.8 of the lower connection piece 33 of the universal joint 310, thereby allowing a pivotal connection between the universal joint 310 and the mop head 420. Additional structures (not shown) to secure the pivot arms 337, 338 in place may be provided. Similar to mop head 410, the mop head 420 may comprise connector receiving slot bushings 441, 442 within the connector receiving opening 440 for receiving the pivot arms 337, 338 of the lower connection piece 330, thereby allowing a pivotal connection between the universal joint 310 and the mop head 420. Additional structures (not shown) to secure the pivot arms 337, 338 in place may be provided. The pivot connection between the lower connection piece 330 and the mop head 400 (For example, mop heads 410 and 420) allow for multi axial pivoting such as flipping, turning, or rotating of the mop head 400 relative to the connector assembly 300 at predetermined angles. The universal joint 310 of the connector assembly 300 may

also allow for ease of use because it may facilitate easy attachment and detachment of mop heads 410 and 420 (Fig. 1D) from one or more bodies 200 (Fig. 1B) while providing a user with universal pivoting and steering capability. Further, the connector assembly 300 may also allow for use of both first and second opposing surfaces of the mop heads 410, 420 for cleaning or treatment.

[0021] As illustrated in an embodiment of Fig. 1E, the mop head 420 may be oriented at an angle relative to the universal joint 310. The longitudinal and transverse axes 45, 46 may define a plurality of axes of rotation of the mop head 420 relative to the universal joint 310. The mop head 420 may rotate about the transverse axis 460 relative to the longitudinal axis 450. The pivotal connection between the mop head 420 and the universal joint 310 may facilitate such a movement. For example, the mop head 420 may be turned at 180° angle relative to the universal joint 310 to allow user to use both the first and second surfaces of the mop head 420 for cleaning or treatment.

[0022] An embodiment of surface treatment system 100 may be assembled as a steam mop 1000 (Figs. 2-8) for steam cleaning operations. Steam mops may include devices similar to those described in the commonly owned U.S. Pat. No. 8,205,293, which is hereby incorporated by reference in its entirety for all purposes. In such an embodiment, the body 200 may comprise a steam source 240, and steam from the steam source 240 may be directed to the mop head 400 through the connector assembly 300. In such an embodiment, the connector assembly 300 may comprise a connector housing 380 (refer to Fig 1C) in addition to the universal joint 310. The connector housing 380 may provide a conduit to direct steam from the steam source 240. In an embodiment, the connector housing may comprise a flexible steam hose (not shown) to direct steam from the steam source 240 to the mop head 400. The upper end of the steam hose may connect to the steam source 240 and the lower end of the steam hose may connect to the mop head 400.

[0023] As illustrated in Fig. 2A, an exemplary embodiment of a steam mop 1000 may be used for cleaning or otherwise treating a surface, such as wood or laminate flooring. It should be appreciated that the steam mop 1000 described herein may also be used as treatment apparatus that treat or operate on a surface to perform one or more functions other than cleaning. As illustrated in Figure 2A, an embodiment of the steam mop 1000 may comprise a body 2000 (not shown), a mop head 1040, and a connector assembly 1060. The connector assembly 1060 may comprise of any swiveling mechanism such as a universal j oint 1060, which may comprise an upper component 1030 and a lower component 1020. The upper component 1030 of the universal joint 1060 may pivotally connect to the body 2000 and the lower component 1020 of the universal joint 1060 may pivotally connect to the mop shaft 1040. The universal joint 1060 may include any suitable connection mechanism to allow various degrees of freedom of movement between: the lower component 1020 of the universal connector 1060 and the mop head 1040, and the upper component 1030 of the universal connector 1060 and the body 2000. Steam to the steam mop may be provided through a steam source, which may either be an internal steam source 240 or an external steam source (not shown).

[0024] In an embodiment, the mop head 1040 is configured to pivotally rotate relative to the connector assembly 1060 from a first position 1800 wherein the second opposing surface 1140 of the mop head may be facing upwardly (as shown in Fig. 2B) to a second position 1850 wherein the first opposing surface 1120 of the mop head may be facing upwardly 1850. In an embodiment, the change in angle between a first position 1800 of the mop head 1040 wherein the second opposing surface 1140 of the mop head may be facing upwardly to the second position 1850 of the mop head wherein the first opposing surface 1120 of the mop head may be facing upwardly may be about 180°, resulting in the mop head 1040 being flipped over.

[0025] The mop head 1040 may be configured to include mop head body 1080, which may include at least one mop head steam inlet 1100 configured to receive steam and first and second opposing surfaces 1120, 1140 configured to output steam towards an area (not shown), such as a floor surface. As stated above, steam may be generated by a steam source 240 or steam generator (not shown) coupled to the steam mop 1000 and fed to the mop head steam inlet 1100. In an embodiment, steam may be provided from a steam generator (not shown) and through the connector assembly 1060 to the mop head steam inlet 1100. In an embodiment, the mop head 1040 may include additional mop head steam inlet 1100. In an embodiment, the mop head 1040 may further include a fluid conduit defined in the mop head body 1080, the fluid conduit 1160 extending from the at least one mop head steam inlet 1100 of the mop head body 1080 to the first and second opposing surfaces 1120, 1140 of the mop head body 1080, thereby defining at least first and second mop head steam paths 1180, 1200 to the first and second opposing surfaces 1120, 1140 of the mop head body 1080, respectively.

[0026] A cleaning pad (not shown) may be attached to the mop head 1040 covering the first and second opposing surfaces 1120, 1140, and steam may output from the first and second opposing surfaces 1120, 1140 through the cleaning pad to clean a surface. In an embodiment, steam may be output from the both the first and second opposing surfaces 1120, 1140 at the same time regardless which side is being applied to the floor for cleaning. However, the steam escaping from the upward facing side would decrease energy efficiency resulting in the steam temp delivered to the downward facing side to be lowered.

[0027] In an embodiment, a change-over device 1300 may be disposed at least partially in the fluid conduit 1160. The change-over device 1300 may be configured to move between a first change-over device position,

which is located in the first mop head steam path 1180 as shown in Fig. 2B, and a second change-over device position, which is located in the second mop head steam path 1200, as shown in Fig. 2C. Referring to Fig. 2B, when the mop head 1040 is oriented in the second position wherein the second opposing surface 1140 of the mop head may be facing upwardly 1800, the first opposing surface 1120 of the mop head 1040 may be facing downwardly towards a cleaning area (not shown), such as a floor, and the change-over device 1300 may be located in the first change-over device position. The change-over device 1300 may be configured to move into the second change-over device position by any suitable means. For example, in an embodiment, the change-over device 1300 may be configured to move into the second change-over device position by gravitational force, force exerted manually, mechanical force triggered by an actuation device or any other suitable means.

[0028] In the first change-over device position, the change-over device 1300 would leave the first mop head steam path 1180 unobstructed while blocking the second mop head steam path 1200. This would allow steam to be provided through the first mop head steam path 1180 and output on the first opposing surface 1120 of the mop head body 1080 but prevent steam in the fluid conduit 116 from being output on the second opposing surface 1140 of the mop head body 1080.

[0029] Referring to Fig. 2C, when the mop head 1040 is oriented in a second position wherein the first opposing surface 1120 of the mop head may be facing upwardly 1850, the second opposing surface 1140 of the mop head 1040 may be facing downwardly towards a cleaning area (not shown), such as a floor, and the change-over device 1300 may be located in the second change-over device position. The change-over device 1300 may be configured to move into the first change-over device position by any suitable means. For example, in an embodiment, the change-over device 1300 may be configured to move into the first change-over device position by gravitational force, force exerted manually, or by mechanical force triggered by an actuation device.

[0030] In the second change-over device position, the change-over device 1300 would block the first mop head steam path 1180 while leaving the second mop head steam path 1200 unobstructed. This would allow steam to be provided through the second mop head steam path 1200 and output on the second opposing surface 1200 of the mop head body 1080 but prevent steam in the fluid conduit 1160 from being output on the first opposing surface 1120 of the mop head body 1080.

[0031] Configured as such, the change-over device 1300 allows steam to be provided through the first opposing surface 1120 or the second opposing surface 1140 only when the mop head 104 is oriented with the first opposing surface 1120 or the second opposing surface 1140 facing downwardly towards a cleaning area, respectively. At the same time, the change-over device 1300 prevents steam from being provided through the first opposing surface 1120 or the second opposing surface 1140 when they are facing upwardly away from a cleaning area. Doing so would increase cleaning performance and energy efficiency as more heat is directed towards the cleaning surface and less heat is lost away from the cleaning surface.

[0032] In an embodiment, the mop head 1040 may be configured to include a first and second steam chambers 1420, 1440 defined in the first and second opposing surfaces 1120, 1140 of the mop head body 1080. Configured as such, the fluid conduit 1160 extends from the mop head steam inlet 1100 of the mop head body 1080 into the first and second steam chambers 1420, 1440, from which steam may be output from the first and second opposing surfaces 1120, 1140 as discussed above. In particular, the first mop head steam path 1180 may be defined, at least partially, by the fluid conduit 1160 and the first steam chamber 1420, and the second mop head steam path 1200 may be defined, at least partially, by the fluid conduit 1160 and the second steam chamber 1440. Depending on the orientation of the mop head 1040, the change-over device 1300 may block one of the first and second mop head steam paths 1180, 1200 while leaving the other one of the first and second mop head steam paths 1180, 1200 unobstructed as discussed above.

[0033] It is to be appreciated that the change-over device 1300 may be configured in a variety of ways in accordance with the principles disclosed herein. In an embodiment, as illustrated in Figs. 2A-2C, the change-over device 1300 may include a change-over device body 1500 disposed at least partially in the fluid conduit 1160. The change-over device body 1500 may have a first and second end portions 1520, 1540, and first and second shoulders 1560, 1580 extending outwardly from the first and second end portions 1520, 1540, respectively. The first shoulder 1560 and the change-over device body 1500 are configured to cooperate to block the second mop head steam path 1200 when the change-over device 1300 is in the first change-over device position, and the second shoulder 1580 and the change-over device body 1500 are configured to cooperate to block the first mop head steam path 1180 when the change-over device 1300 is in the second change-over device position.

[0034] In an embodiment, the first shoulder 1560 comprises a sealing element 1600, such as an O-ring, disposed on a shoulder surface 1620 facing the second shoulder 1580. The second shoulder 158 may also comprise a similar sealing element 1640 disposed on a shoulder surface 1660 facing the first shoulder 1560. In an embodiment, the shoulder surfaces 1620 and 1640 may be sloped thereby giving the change-over device body 1500 an hourglass shape and a trapezoidal cross-sectional profile as illustrated in Figs. 2B and 2C.

[0035] It is to be appreciated that the mop head 1040 may have a variety of configurations to accommodate the configurations of the change-over device 1300. In an

embodiment, the change-over device 1300 may include a ball valve and the mop head 1040 may adopt the configuration of a mop head 2000 as shown in Figures 3A-3D.

[0036] Referring to Figures 3A-3D, a mop head 2040 may be configured similarly to mop head 1040, except that the change-over device may include a valve 2300, and the fluid conduit 2160 may be configured differently from the fluid conduit 1160 to define first and second mop head steam paths 2180, 2200 different from the first and second mop head steam paths 1180, 1200. In an embodiment, the fluid conduit 2160 may extend from the mop head steam inlet 2100 along the first mop head steam path 2180 through a portion of the second opposing surface 2140 to the first opposing surface 2120 as shown in Fig. 3C. Additionally, the conduit 2160 may extend from the mop head steam inlet 2100 along second mop head steam path 2200 through a portion of the first opposing surface 2120 to the second opposing surface 2140 as shown in Fig. 3D. In an embodiment, the valve 2300 may include a sealing element 2340 disposed in a cavity 2320 defined the fluid conduit 2160. In an embodiment, the valve 2300 may comprise a ball valve and the sealing element 2340 may comprise a substantially spherical configuration, such as a ball, and may be made of any suitable material, such as a metal, polymer, Teflon, etc. The sealing element 2340 may be configured to move between a first valve position, which is located in the second mop head steam path 2200 as shown in Fig. 3C, and a second valve position, which is located in the first mop head steam path 2180, as shown in Fig. 3D.

[0037] Referring to Fig. 3C, when the mop head 2040 is oriented in the second position wherein the second opposing surface 2140 of the mop head may be facing upwardly 2800, the first opposing surface 2120 of the mop head 2040 may be facing downwardly towards a cleaning area (not shown), such as a floor, and the sealing element 2340 may be located in the first valve position in the second mop head steam path 2200, the sealing element 2340 would leave the first steam path 2180 unobstructed while blocking the second steam path 2200. This would allow steam to be provided through the first mop head steam path 2180 and output on the first opposing surface 2120 but prevent steam in the fluid conduit 2160 from being output on the second opposing surface 2140.

[0038] Referring to Fig. 3D, when the mop head 2040 is oriented in the second position wherein the first opposing surface 212 of the mop head may be facing upwardly 2850, the second opposing surface 2140 of the mop head 2040 may be facing downwardly towards a cleaning surface (not shown), such as a floor, and the sealing element 2340 may be located in the second valve position in the first steam path 2180. In the second valve position, the sealing element 2340 would block the first mop head steam path 2180 while leaving the second mop head steam path 2200 unobstructed. This would allow steam to be provided through the second mop head steam path 2200 and output on the second opposing surface 2200 but prevent steam in the fluid conduit 2160 from being output on the first opposing surface 2120.

[0039] Figures 4A-4C illustrate another embodiment of a steam mop 3000. The steam mop 3000 may include a mop head 3040 and a lower component 3020 of a universal joint 3060 having an end portion 3050 pivotably connected to the mop head 3040. In an embodiment, the end portion 3050 may include a pivoting steam vent 3080, which may be fluidly connected to a steam source 240 (not shown) such as a steam generator. This pivoting steam vent 3080 may be a part of the lower component 3020 of the universal joint 3060 and pivots on the same axis as the lower component 3020 of the universal joint 3060 and not independently of the lower component 3020 of the universal joint 3060. In an embodiment, the pivoting steam vent 3080 may include a single nozzle configured to provide steam from the steam source 240 to the mop head 3040. In an embodiment, the pivoting steam vent 3080 may include a plurality of nozzles configured to provide steam from the steam source 240 to the mop head 3040.

[0040] In an embodiment, the mop head 304 may include a first steam chamber 3420, which may include a first steam chamber inlet 3460 and may be configured to output steam on a first opposing surface 3120 of the mop head 3040. The mop head 3040 may further include a second steam chamber 3440, which may include a second steam chamber inlet 3480 and may be configured to output steam on a second opposing surface 3140 of the mop head 3040.

[0041] Like the mop heads 1040 and 2000, the mop head 3040 may be configured to pivotably rotate relative to connector assembly from a second position to a first position. When the mop head 3040 is oriented in the second position wherein the second opposing surface 3140 of the mop head is facing upwardly, the first steam chamber inlet 3460 may be configured to align with the pivoting steam vent 3080 of the lower component 3020 of the universal joint 3060, thereby allowing steam to be provided to the first steam chamber 3420 and to be output on the first opposing surface 3120 of the mop head 3040. When the mop head 3040 is oriented in the second position wherein the first opposing surface 3120 of the mop head is facing upwardly, the second steam chamber inlet 3480 is configured to align with the pivoting steam vent 3080 of the lower component 3020 of the universal joint 3060, thereby allowing steam to be provided to the second steam chamber 3440 and to be output on the second opposing surface 3140 of the mop head 3040.

[0042] It is to be appreciated the alignment of the pivoting steam vent 3080 with either the first or second steam chamber inlet 3460, 3480 allows the steam to be provided only to the steam chamber that is outputting steam towards a cleaning surface (not shown), which in turn, allows for increased energy efficiency and cleaning performance like the mop heads 1040 and 2040 as discussed above.

[0043] It is to be further appreciated that the steam mop heads 1040, 2040, and 3040 may be configured to include at least one steam vent 4000 as shown in Figure 5 to allow residual and/or excess steam to escape to from a downward facing steam chamber 4020 to an upward facing steam chamber 4040. In an embodiment, the steam vent 4000 may include one or more apertures defined through a portion of the mop head 4040, thereby fluidly connecting the steam chambers 4020 and 4040. In an embodiment, a flow regulation device such as a shut-off valve (not shown) may open or block the fluid passage through the steam vent 4000, either automatically or upon actuation by a user.

[0044] In an embodiment of a surface treatment apparatus 100 illustrated in Fig. 1A-E, when the apparatus is used for steam cleaning operations, the connector housing 380 may comprise of a connector steam inlet, a connector steam conduit (shown in Figs. 7 and 8) comprising a first and second connector steam paths (shown in Figs. 7 and 8), and a steam blast nozzle assembly (shown in Figs. 7 and 8) in fluid communication with one of the first and second connector steam paths (shown in Figs. 7 and 8). Figures 6A-D represent an exemplary embodiment of a surface steam mop 100 with different angular orientations of the mop head 400 relative to the connector assembly 300. The mop head 400 in each of the illustrated embodiments has two opposing surfaces, a first opposing surface 510 and a second opposing surface 520.

[0045] In the illustrated embodiments of the mop head in Figs. 6A and 6B, the mop head 400 may be configured to be oriented in a first position 600 relative to the connector assembly 300, and in the illustrated embodiments of the mop head in Figs. 6C and 6D, the mop head 400 may be configured to be oriented in a second position 700 relative to the connector assembly 300. When the mop head is in the first position 600, as illustrated in Fig. 6A, the first opposing surface 510 of the mop head 400 may be facing upwardly and is oriented at a first predetermined angle 530 relative to the connector assembly 300; and as illustrated in Fig. 6B, the second opposing surface 520 of the mop head 400 may be facing upwardly and is oriented at a first predetermined angle 530 relative to the connector assembly 300. When the mop head is in the second position 700, as illustrated in Fig. 6C, the first opposing surface 510 of the mop head 400 may be facing upwardly and is oriented at a second predetermined angle 540 relative to the connector assembly 300; and as illustrated in Fig. 6D, the second opposing surface 520 of the mop head 400 may be facing upwardly and is oriented at a second predetermined angle 540 relative to the connector assembly 300.

[0046] In the embodiments in Figs 6C and 6D, steam may be directed from the connector housing 380 (shown in Figs. 7 and 8) along one of the first and second connector steam paths (shown in Figs. 7 and 8) to the mop head 400 to be output in a normal area cleaning mode 700. In the embodiment in Figs 6A and 6B, steam may be directed from the connector housing 380 along the other one of the first and second connector steam paths to the steam blast nozzle assembly (shown in Figs. 7 and 8) to be output in a steam blast mode 600. The steam blast mode of operation 600 or the normal area cleaning mode of operation 700 may be actuated depending on the first or the second predetermined angles 530 and 540 of the mop head 400 relative to the connector assembly 300. As illustrated in Figs. 6A and 6B, the mop head 400 may be oriented at a first predetermined angle 530 relative to the connector assembly 300 thereby allowing steam blast mode of operation 600, and in Figs. 6C and 6D, the mop head 400 may be oriented at a second predetermined angle 540 relative to the connector assembly 300 thereby allowing normal area cleaning mode of operation 700. The first predetermined angle 530 relative to the mop head may be an acute angle (example, Figs. 6A and 6B) and the second predetermined angle 540 relative to the mop head may be an obtuse angle (example, Figs. 6C and 6D).

[0047] It may be noted that the coverage of area may be large in a normal area cleaning mode of operation 700 compared to the steam blast mode of operation 600 while the velocity of steam output in a steam blast mode of operation 600 may be higher than the normal area cleaning mode of operation 700. As such, the steam blast mode of operation 600 may be effective and efficient in cleaning or treating hard to remove or messy stains. It may be further noted that the steam blast in steam blast mode of operation relies on velocity and hydration to break down the hard to remove mess. For example, if we think about a hard to remove mess as a buildup of layers, as the steam begins to hydrate the top layer mess, the top layer mess moves out of the way due to the velocity of the steam output, thereby revealing the next layer of the mess to be hydrated.

[0048] Figures 7A-7K depict illustrations of exemplary embodiments of a steam mop 7000 which may be configured to discharge steam in a normal area cleaning mode and a steam blast mode depending upon the angle of the mop head 7300 relative to the connector assembly 7200. In an embodiment, the steam mop 7000 may comprise a mop head 7300 with a change-over device configured in accordance with the principles disclosed in the present application, including but not limited to any embodiments as described in Figs. 2A-2C or Figs.3A-3D or 4A-4C.

[0049] In Figures 7A through 7F, an exemplary embodiment of the steam mop 7000 may comprise a connector assembly 7200 (an embodiment of connector assembly 300 of Figs. 1A, 1C), and a mop head 7300 (an embodiment of mop head 400 of Figs. 1A, 1D),. The connector assembly 7200 may comprise a universal joint 7201, which may be configured to connect to the mop head 7300 and a connector housing 7202 (an embodiment of connector housing 380 of Fig. 1C) which may comprise a connector steam inlet 7302, a connector steam conduit 7204, and a steam blast nozzle assembly

7400. The connector steam inlet 7302, the connector steam conduit 7204, the steam blast nozzle assembly 7400 may be fluidly connected to each other. The connector steam inlet 7302 may be fluidly connected to the steam source 240 thereby receiving steam from the steam source 240 and directing the received steam to the connector steam conduit 7204. The connector steam conduit 7204 may comprise a first connector steam path 7205 and a second connector steam path 7206 allowing steam to be selectively directed through the first connector steam path 7205 to the steam blast nozzle assembly 7400 or through the second connector steam path 7206 to the mop head 7300. The mop head 7300 may comprise of a first opposing surface 7301 and a second opposing surface 7302.

[0050] As illustrated in Fig. 7A, the mop head 7300 is in a second predetermined angle (refer to Figs. 6C and 6D) relative to the connector assembly 7200 thereby defining a second position of the mop head 7300 relative to the connector assembly 7200 and steam in such an embodiment may be directed through the second connector steam path 7206 to the mop head 7300, thereby actuating a normal area cleaning mode of operation. As illustrated in Fig. 7B, the mop head 7300 is in a first predetermined angle (refer to Figs. 6A and 6B) relative to the connector assembly 7200 thereby defining a first position of the mop head 7300 relative to the connector assembly 7200 and steam in such an embodiment may be directed through the first connector steam path 7205 to the steam blast nozzle assembly 7400, thereby actuating a steam blast mode of operation 7401.

[0051] Referring to Fig 7C, a partial cut away view of the illustrated embodiment of Fig, 7A with a longitudinal cross sectional view of the mop head 7300 is shown. Referring to Fig. 7D, a longitudinal cross sectional view of both the connector assembly 7200 and the mop head 7300 of an exemplary embodiment described in Fig. 7A is shown. As illustrated in an embodiment of Fig. 7D, the steam blast nozzle assembly 7400 may comprise three portions: a nozzle inlet portion 7402, a nozzle intermediate portion 7403, a nozzle outlet portion 7404. In an embodiment, the cross sectional surface area of the nozzle inlet or the nozzle intermediate portions 7402, 7403 may be smaller than the cross sectional surface area of the nozzle outlet portion 7404. In an embodiment, the cross sectional surface area of the nozzle intermediate portion 7403 may be smaller than the nozzle inlet portion 7402 and the nozzle outlet portion 7404.

[0052] In an embodiment, the nozzle inlet, intermediate and outlet portions 7402, 7403, 7404 may be of any geometrical shape such as a cylinder, cube, cuboid, etc., wherein the nozzle inlet, intermediate and outlet portions 7402, 7403, 7404 may be of the same geometrical shape or of a different geometrical shape relative to each other. In an embodiment, the nozzle outlet portion 7404 may be substantially conical in shape as illustrated in Fig.7D. The shape and/or size and/or angular orientation of the nozzle inlet, intermediate, outlet portions 7402, 7403, 7404 of the steam blast nozzle assembly 7400 may determine the velocity and profile of the steam blast. For example, the velocity of the steam blasting out of the steam blast nozzle assembly 7400 may be defined by a narrow cross sectional surface area of the nozzle intermediate portion 7403 relative to the nozzle inlet and outlet portions 7402 and 7404. A narrow nozzle intermediate portion 7303 may define a higher velocity steam blast. Moreover, the narrow cross sectional surface area of the nozzle intermediate portion 7403 relative to the nozzle inlet and outlet portions 7402 and 7404 may also determine the sound of the steam blast (audible jet). In an embodiment, the shape of the nozzle outlet portion 7404 may define a steam blast profile.

[0053] As illustrated in Fig.7D, the mop head 7300 may comprise a mop head steam inlet 7304 to receive steam to the mop head 7300 thereby allowing steam to be output through the first and/or second opposing surfaces 7301, 7302 of the mop head 7300. It may be noted that a mop head steam inlet 7304 may comprise one or more mop head steam inlets 7304. Fig. 7E is a longitudinal cross sectional view of the connector assembly 7200 and the mop head 7300 of the embodiment illustrated in Fig. 7B depicting the steam blast mode of operation 7401. The steam that exits the nozzle outlet portion 7404 of the steam blast nozzle assembly 7400 may appear as a steam blast or a steam jet 7405. The solid line 7407 illustrates a steam flow through the connector steam inlet 7302 and the first connector steam path 7205 of the connector steam conduit 7204 to the steam blast nozzle assembly 7400 and finally to outside through the steam blast nozzle assembly 7400 as a steam blast.

[0054] Fig. 7F is a longitudinal cross sectional view of the connector assembly 7200 and the mop head 7300 of the embodiment illustrated in Fig. 7A depicting the normal area cleaning mode of operation 7303. The solid line 7305 illustrates a steam flow through the connector steam inlet 7203 and the second connector steam path 7206 of the connector steam conduit 7204 to the mop head steam inlet 7304, which may be output through the first or second opposing surfaces 7301, 7302 of the mop head 7300, thereby allowing the steam to be used for normal area cleaning.

[0055] In an embodiment, the connector housing 7202 may further comprise a valve mechanism 7700 configured to switchably direct a steam flow through the first connector steam path 7205 to the steam blast nozzle assembly 7400 (example, Fig. 7H) or the second connector steam path 7206 to the mop head steam inlet 7304 (example, Fig. 7G). In an embodiment, the valve mechanism 7700 may be disposed in at least a portion of the first connector steam path 7205 or at least a portion of the second connector steam path 7206 or both. The valve mechanism 7700 may be configured to include a first baffle 7710 and a second baffle 7720, which cooperate to form at least a portion of the first connector steam path 7205 or at least a portion of the second connector steam path 7206 depending on relative position of the first and

second baffles 7710 and 7720.

[0056] The first and second baffles 7710 and 7720 have a first relative position 7730 when the mop head 7300 is oriented at a first predetermined angle 530 relative to the connector assembly 7200 (example, Fig. 7H) and a second relative position 7740 when the mop head 7300 is oriented at a second predetermined angle 540 relative to the connector assembly 7200 (example, Fig. 7G). In the first relative position of the first and the second baffles 7710 and 7720, the second connector steam path 7206 may be blocked (example, Fig. 7H), and in the second relative position of the first and the second baffles 7710 and 7720, the first connector steam path 7205 may be blocked (example, Fig. 7G). As may be illustrated in Figs. 7G and 7H, the first baffle 771 may comprise a first spring member 7711, a first baffle member 7712, a first sealing element 7713, and a second sealing element 7714 such that the first baffle member 7712 is biased in an open position by the first spring member 7711. The sealing elements may comprise of any sealing mechanism such as O-rings. The first spring member 7711 may have a first and a second end, and the first baffle member 7712 may have a first end and a second end.

[0057] The first baffle member 7712 may have an elongated grove 7715. The first sealing element 7713 may be located adjacent to the first end of the first baffle member 7712 and the second sealing element 7714 may be located adjacent to the second end of the first baffle member 7712. It may be noted that the location of the sealing elements 7713, 7714 on the first baffle member 7712 may be varied in some embodiments. In the first relative position (example, Fig. 7H), the first end of the first baffle member 7712 may be located on the second end of the first spring member 7711 and in the second relative position (example, Fig. 7G), the first end of the first baffle member 7712 may move close towards the first end of the first spring member 7711.

[0058] Similarly, the second baffle 772 comprises a second spring member 7721, a second baffle member 7722, a third sealing element 7723, and a fourth sealing element 7724. The second baffle member 7722 may be biased in an open position by the second spring member 7721. The second spring member 7721 may have a first and a second end and the second baffle member 7722 may also have a first end and a second end. The third sealing element 7723 may be located adjacent to the first end of the second baffle member 7722 and the fourth sealing element 7724 may be located adjacent to the second end of the second baffle member. The positions or locations of the sealing elements 7723, 7724 on the second baffle member 7722 may be varied. The second end of the second baffle member 7722 may movably extend into the elongated grove 7715 of the first baffle member 7712 such that the second end of the second baffle member 7722 may abut the first end of the elongated grove 7715 of the first baffle member 7712 in the first relative position (example, Fig. 7H) and the second end of the second baffle member 7722 may abut the second end of the elongated grove 7715 of the first baffle member 7712 in the second relative position (example, Fig. 7G). As such, in the first relative position (example, Fig. 7H), the first end of the second baffle member 7722 moves close towards the first end of the second spring member 7721 and in the second relative position (example, Fig. 7G), the first end of the second baffle member 7722 may be located on the second end of the second spring member 7721. In Fig. 7G, the circled rings 7716 represent sealed steam blast path and in Fig. 7H, the circled rings represent sealed normal area cleaning path.

[0059] In yet another exemplary embodiments of the steam mop 7000 as illustrated in Figs. 7I-7K, the valve mechanism described in Figs. 7G and 7H may be configured to comprise of different valve mechanisms. In an exemplary embodiment of the steam mop 7000 illustrated in Fig 7I, the steam mop 7000 may comprise of a mop head 7300 with a change-over device 1300 or 2300 or 3300 as described in Figs. 2A-2C or Figs.3A-3D or 4A-4C. In such an embodiment as illustrated in Fig. 7I, the valve mechanism 7700 may comprise of a single baffle 7740 extending at least partially from the change-over device of the mop head 7300 and at least partially disposed in the first connector steam path 7205 and the second connector steam path 7206 thereby allowing to control the direction of the steam flow to the steam blast nozzle assembly 7400 or the mop head 7300.

[0060] The single baffle 7740 may comprise a baffle spring member 7741, a baffle member 7742, a first sealing element 7743, and a second sealing element 7744. In path 1 in Fig. 7I, steam is directed to the mop head 7300 and in path 2 in Fig. 7I, steam is directed to the steam blast nozzle assembly 7400. In an another embodiment of the steam mop that is illustrated in Fig. 7I, the valve mechanism 7700 may comprise of a first and second baffles such that the first baffle extends at least partially from the change-over device of the mop head 7300 located at least partially in the first steam chamber of the mop head 7300 and the second baffle extends at least partially from the change-over device of the mop head 7300 located at least partially in the second steam chamber of the mop head, thereby allowing to control the direction of the steam flow to the steam blast nozzle assembly 7400 (path 2) or the mop head 7300 (path 1).

[0061] Figs. 7J and 7K illustrate additional embodiments of a valve mechanism 7700. The valve mechanism 7750 in Fig. 7J or valve mechanism 776 in Fig. 7K would allow or block the steam flow to the mop head 7300 or to the steam blast nozzle assembly 7400 either by directing the steam flow entirely either to the steam blast nozzle assembly 7400 (Path 2) or to the mop head 7300 (Path 1) or by blocking the steam flow to the steam blast nozzle assembly 7400 or the mop head 7300 depending upon the first or second position of the mop head 7300 relative to the connector assembly 7200 (refer to Figs. 6A-6D). The valve mechanism 7750 may comprise a spring member 7751, a valve member 7752, and two sealing elements 7753 and 7754, respectively. Likewise, the valve

mechanism 7760 may comprise a spring member 7761, a valve member 7762, and a sealing member 7763 and 7764, respectively.

[0062] Figures 8A-8K illustrate an exemplary embodiment of a steam mop 8000 which may be configured to discharge steam in a normal area cleaning mode and a steam blast mode with or without scrubbing action. In Fig. 8A, an exemplary embodiment of the steam mop 8000 comprising a connector assembly 8200 (an embodiment of connector assembly 300 of Figs. 1A, 1C), and a mop head 8300 (an embodiment of mop head 400 of Figs. 1A, 1D) are illustrated. The connector assembly 8200 comprises a universal joint 8201, which is configured to connect to the mop head 8300 and a connector housing 8202 (an embodiment of connector housing 380 of Fig. 1C) which may comprise a connector steam inlet 8203, a connector steam conduit 8204, and a steam blast nozzle assembly 8400.

[0063] The connector steam inlet 8203, the connector steam conduit 8204, the steam blast nozzle assembly 8400 may be fluidly connected to each other. The connector steam inlet 8203 may be fluidly connected to the steam source 240 thereby receiving steam from the steam source 240 and transmitting the received steam to the connector steam conduit 8204. The connector steam conduit 8204 may comprise a first connector steam path 8205 and a second connector steam path 8206 so as to direct the steam through the first connector steam path 8205 to the steam blast nozzle assembly 8400 or through the second connector steam path 8206 to the mop head 8300.

[0064] The mop head 8300 may comprise of a first opposing surface 8301 and a second opposing surface 8302 and a mop head 8300 housing 8330 enclosed in between the first and second opposing surfaces 8301 and 8302. The mop head 8300 housing 8330 may comprise of one or more mop head 8300 steam inlets 8304 o receive steam from the connector housing and one or more mop head 8300 steam outlets 8305 fluidly connected to each other such that steam is directed from the mop head 8300 steam inlet 8304 to the mop head 8300 steam outlets 8305 to be output on the cleaning area. In a mop head 8300, a fluid conduit (not shown) fluidly connecting the mop head 8300 steam inlet 8304 to the mop head 8300 steam outlet 8305 may be present. The mop head 8300 steam inlet 8304 may be fluidly connected to the connector housing 8202. The mop head 8300 may be made of any geometric shape such as triangular (as illustrated in Fig. 8A), rectangular or any shape and may be made of any material.

[0065] In an embodiment, the first opposing surface 8301 is not configured to output steam. For example, the first opposing surface 8301 may comprise a rigid casing made of any material such as plastic, metal etc. and/or may be a closed structure. As such, such a mop head 8300 may not be flipped over so that the second opposing surface 8302 may face upwardly. In such a mop head 8300, the first opposing surface is the only surface that always faces upwardly.

[0066] In an embodiment, the mop head 8300 may comprise a base 8311, a right wall 8312, a left wall 8313. The connector assembly 8200 may be pivotally connected to the base 8311. The second opposing surface 8302 may comprise a cleaning pad holding surface and is configured to output steam onto the area to be cleaned or treated. A cleaning pad 8309 may be removably attached to the cleaning pad holding surface of the second opposing surface 8302, thereby allowing steam to be output through the cleaning pad 8309 on to the area to be cleaned/treated. The mop head 8300 may define a connector receiving portion 8340 which may be of any shape and which receives at least a portion of the connector housing. The universal joint 8201 may be pivotally connected to the connector receiving protrusions 8341 and 8342. The steam blast nozzle assembly 8400 may at least partially extend into the connector assembly 8200 as illustrated in Fig. 8A.

[0067] In one embodiment, as illustrated in Fig. 8B, the mop head 8300 is at a second predetermined angle A_2 (substantially similar to the second predetermined angle described in Figs. 6C) relative to the connector assembly 8200 thereby defining a second position of the mop head 8300 relative to the connector assembly 8200. In such an embodiment, steam may be directed through the second connector steam path 8206 (Figs. 8D-8E) to the mop head 8300, thereby defining an normal area cleaning mode of operation 8303.

[0068] As illustrated in Figs. 8D-8E, the first connector steam path 8205 may be fluidly connected to the steam blast nozzle assembly 8400 and the second connector steam path 8206 may be connected to the mop head 8300. In an exemplary embodiment of the steam mop 8000 as illustrated in Fig. 8C, the mop head 8300 is at a first predetermined angle A_1 (substantially similar to the first predetermined angle described in Figs. 6A) relative to the connector assembly 8200 thereby defining a first position of the mop head 8300 relative to the connector assembly. In such an embodiment, steam may be directed through the first connector steam path 8205 (Figs. 8D-8E) to the steam blast nozzle assembly 8400, thereby defining a steam blast mode of operation 8401.

[0069] Referring to Figs. 8D and 8E, a longitudinal cross sectional view of both the connector assembly 8200 and the mop head 8300 of an exemplary embodiment described in Fig. 8A may be illustrated. The steam blast nozzle assembly 8400 may be configured in a variety of ways as described in Figs. 7A-7K. Fig. 8D is a longitudinal cross sectional view of the connector assembly 8200 and the mop head 8300 depicting the normal area cleaning mode of operation 8303. The solid line 8307 illustrates a steam flow through the connector steam inlet 8203 and the second connector steam path 8206 of the connector steam conduit 8204 to the mop head 8300 steam inlet 8304 , which may be output through the second opposing surface 8302 of the mop head 8300, thereby allowing the steam to be used for

normal area cleaning.

[0070] Fig. 8E is a longitudinal cross sectional view of the connector assembly 8200 and the mop head 8300 depicting the steam blast mode of operation 8401. The steam that exits the nozzle outlet portion 8404 of the steam blast nozzle assembly 8400 may appear as a steam blast or a steam jet. The solid line 8407 illustrates a steam flow through the connector steam inlet 8203 and the first connector steam path 8205 of the connector steam conduit 8204 to the steam blast nozzle assembly 8400 and finally to outside through the steam blast nozzle assembly 8400 as a steam blast.

[0071] In an exemplary embodiment 800 of a steam mop as illustrated in Figs. 8F and 8I, the embodiment may comprise a valve mechanism 8700 to direct the steam flow: to the mop head 8300, thereby allowing normal area cleaning mode of operation 8403 (example, Fig. 8H) or to the steam blast nozzle assembly, thereby allowing steam blast mode of operation (example, Fig. 8I). In the illustrated embodiment of Figs. 8F and 8I, the connector housing 8202 may further comprise a valve mechanism 8700 configured to switchably direct a steam flow through the first connector steam path 8205 to the steam blast nozzle assembly 8400 (example, Fig. 8I) or the second connector steam path 8206 to the mop head 8300 steam inlet 8304 (example, Fig. 8H), wherein the valve mechanism 8700 may be disposed in at least a portion of the first connector steam path 8205 or at least a portion of the second connector steam path 8206 or both.

[0072] The valve mechanism 8700 may be the valve mechanism as illustrated in Figs. 7G and 7H or may be a change-over valve mechanism that resembles the change-over device illustrated in Figs. 2A-2C or Figs.3A-3D or 4A-4C. The valve mechanism 8700 may comprise a variety of valve mechanisms. In one embodiment, as illustrated in Fig. 8F, the valve mechanism 8700 may be a change-over device 8800 that may be disposed at least partially in the first connector steam path 8205 and the second connector steam path 8206. The change-over device 8800 may be configured to move between a first change-over device position, which is located in the first connector steam path 8205, and a second change-over device position, which is located in the second connector steam path 8206.

[0073] When the mop head 8300 is oriented in the second position, the change-over device 8800 may be located in the second change-over device position. The change-over device 8800 may be configured to move between the first and second change-over device positions by any suitable means. For example, the change-over device 8800 may be configured to move into the first or the second change-over device position by gravitational force, force exerted manually, mechanical force triggered by an actuation device or any other suitable means. In the second change-over device position, the change-over device 8800 would block the first connector steam path 8205 while leaving the second connector steam path 8206 unobstructed. This would allow steam to be provided through the second connector steam path 8206 to the mop head 8300. When the mop head 8300 is oriented in the first position, the change-over device 8800 may be located in the first change-over device position. In the first change-over device position, the change-over device 8800 would leave the first connector steam path 8205 unobstructed while blocking the second connector steam path 8206. This would allow steam to be provided through the first connector steam path 8205 to the steam blast nozzle assembly 8400 but prevent steam from being entering the mop head 8300.

[0074] In one embodiment as illustrated in Fig. 8F, the change-over device 8800 may comprise a valve body 8802 , a valve spring member 8801 , a sealing element such as O-ring 8803. The valve body 8802 may comprise of a first end portion and a second end portion. Adjacent to the first end portion, the valve body 8802 may comprise a first and second shoulders 8821, 8822 extending outwardly from the valve body 8802. The first and second shoulders 8821, 8822 may be perpendicular to the valve body. The O-ring 8803 is located at the intersection of the first shoulder 8821 and the valve body 8802 facing the first end portion. The location of the O-ring 8803 may not be considered to be limiting. The change-over device 8800 may be housed in a valve packaging assembly 8701 that also houses a movable baffle 8810. The second end portion of the valve body 8802 may be biased in open position in the valve spring member 8801 while the first end portion extends into a grove located in the movable baffle 8810 which is a part of the valve packaging assembly. The movable baffle 8810 being perpendicularly oriented relative to the change-over device. The movable baffle 8810 may also be positioned in such a way so as to hold the change-over device in place.

[0075] The movable baffle 8810 may comprise an elongated baffle member 8812 with a first end and a second end, a baffle spring member 8813 and three O-rings 8814, 8815 and 8816. The number of O-rings needed may vary. The movable baffle 8810 may be oriented perpendicular to the mop head 8300 and perpendicular to the change-over device 8800. First end of the elongated baffle member 8812 may be biased in open position by the spring member 8813. When the mop is in first position as illustrated in Fig. 8F, the movable baffle 8810 is in first baffle position, wherein the second end of the valve body 8802 moves out of the grove of the elongated baffle member blocking the second connector steam path 8206. In this position, the first and second shoulders, the first and the second O-rings of the change-over device move forward along the spring member thereby allowing the steam to flow through the first connector steam path 8205 into the steam blast nozzle assembly 8400 allowing for steam blast or jet mode. When the mop head 8300 is in second position (not shown in Fig. 8F), the movable baffle 8810 may be in a second baffle position, wherein the second end of the valve body 8802 extends into the grove of the elongated baffle member and the first and second

shoulders, the first and the second O-rings of the change-over device 8800 completely block the first connector steam path 8205 while the second connector steam path 8206 remains open. As such, the steam moves into the mop head 8300 allowing for normal area cleaning.

[0076] As illustrated in Fig. 8F, an actuation mechanism 8208 may be provided to regulate the movement of the change-over device from first change-over device position to the second change-over device position. The actuation mechanism 8208 may be operated manually as in Fig. 8F or may also be operated by any means such as a lever, electric means, automatic means etc. The actuation mechanism 8208 may be provided connected to the connector assembly 8200 as illustrated in Fig. 8F. It is to be noted that the location of the actuation mechanism 8208 may not be considered limiting.

[0077] In another embodiment of the valve mechanism 8700, as illustrated in Figs.8G-8H, the change-over device 8800 may be configured in a variety of ways in accordance with the principles disclosed herein. In an embodiment, as illustrated in Figs. 8G-8H, the change-over device 8800 may include a first valve 8901 disposed at least partially in the first connector steam path 8205 and a second valve 8902 disposed at least partially in the second connector steam path 8206. The first valve 8901 may comprise of a first valve body 8911, a first valve spring member 8912 The first valve body 8911 may comprise of a first end portion and a second end portion. Adjacent to the second end portion, the first valve body 8911 may comprise first and second shoulders 8913, 8914 extending outwardly from the first valve body 8911 such that the first and second shoulders 8913, 8914 may be perpendicular to the first valve body 8911 and the second end portion of the first vale body 8911 is biased in open position in the first spring member 8912.

[0078] The first spring member 8912 may be located adjacent to the spring nozzle assembly 840 in the first connector steam path 8205. A first O-ring 8915 may be located at the intersection of the first shoulder 8913 and the first valve body 8911 towards the first end portion. Further, a second O-ring 8916 may be located at the intersection of the second shoulder 8914 and the first valve body 8911 close towards the first end portion.

[0079] Similarly, the second valve 8902 may comprise of a second valve body 8921, a second valve spring member 8922. The second valve body 8921 may comprise of a first end portion and a second end portion. Adjacent to the second end portion, the second valve body 8921 may comprise a third and fourth shoulders 8923, 8924 extending outwardly from the second valve body 8921 such that the third and fourth shoulders 8923, 8924 may be perpendicular to the second valve body 8921. A third O-ring 8925 may be located at the intersection of the third shoulder 8923 and the second valve body 8921 towards the first end portion. Further, a fourth O-ring 8926 may be located at the intersection of the fourth shoulder 8924 and the second valve body 8921 close towards the first end portion. The first and second valves 8901 and 8902 may be arranged in such a way that they form a straight line wherein the first end portion of the first valve 8901 and the first end of the second valve 8902 touch each other. The first and second valves 8901 and 8902 may be at 180° angle to each other on the same axis.

[0080] The first and second O-rings 8915, 8916 and the first and second shoulders 8913, 8914 of the first valve body 8911 are configured to cooperate to block the first connector steam path 8205 when the change-over device 8800 is in the first position. The third and fourth O-rings 8925 and 8926, the third and the fourth shoulders 8923, 8924 of the second valve body 8921 are configured to cooperate to block the second connector steam path 8206 when the change-over device 8800 is in the second position. The change-over device 8800 along with a movable baffle 8810 may be housed in a valve packaging assembly 8701. The second end portion of the second valve body 8921 may extend into a grove of a movable baffle 8810 .

[0081] The movable baffle 8810 may be located perpendicular to the change-over device 8800. The movable baffle 8810 may be positioned in such a way so as to hold the change-over device 8800 in place. The movable baffle 8810 may comprise an elongated baffle member 8812, a grove 8813 on the elongated baffle member 8812, a spring member 8811 and two O-rings 8814, 8815. The number of O-rings provided may vary. The movable baffle 8810 may be located perpendicular to the mop head 8300. One end of the elongated baffle member 8812 is biased in open position by the spring member 8811. The other end of the elongated baffle member 8812 may have two O-rings 8814, 8815. When the mop head 8300 is in second position (refer to Figs. 6C and 6D) as illustrated in Figs. 8G and 8I, the movable baffle 8810 is in second baffle position, wherein the second end of the second valve body 8921 extends into the grove of the elongated baffle member 8812. As such, the first valve body 8911 completely blocks the first connector steam path 8205 and the steam moves into the mop head 8300 allowing for normal area cleaning. In this embodiment, the second connector steam path 8206 remains open so as to permit the steam flow into the mop head 8300, thereby allowing normal area cleaning mode of operation 8303.

[0082] When the mop head 8300 is in a first position (refer to Fig. 6A and 6B) as illustrated in Fig. 8H, the movable baffle 8810 is in a first baffle position, wherein the second end of the second valve body 8921 moves out of the grove 8813 of the elongated baffle member 8812. As such, the second valve body 8921 completely blocks the second connector steam path 8206 and the first valve body 8911 moves such that the first connector steam path 8205 remains open and the steam moves from the first connector steam path 8205 into the steam blast nozzle assembly 8400 allowing for steam blast or jet blast 8405. The valve mechanism illustrated in Figs. 8F -8I may not be considered limiting.

[0083] As illustrated in Figs. 8J-8P, an exemplary em-

bodiment of steam mop 8000 of Figs. 8A-8I may be provided with a scrubber assembly 8500 for scrubbing action in conjunction with the steam blast. This mechanism allows to scrub the area to be cleaned or treated in conjunction with the steam blast so as to easily and effectively remove messy and hard-to-remove stains or spots. In one embodiment, the scrubber assembly 8500 may at least partially extend into the connector receiving opening of the mop head 8300.

[0084] In an embodiment, the scrubber assembly 8500 may directly or indirectly engage with the connector assembly 8200. For example, the connector assembly 8200 and the scrubber assembly 8500 may move independent of each other or in coordination with each other in certain orientations of the mop head 8300 relative to the connector assembly 8200. In a different embodiment, the scrubber assembly 8500 may directly or indirectly engage with the mop head 8300 or the body 8100.

[0085] The scrubber assembly 8500 may comprise a scrubber base 8501 with two sides, a first side 8502 and a second side 8503, at least one supporting arm 8505 or 8506 (Fig. 8L), and a scrub member such as a scrub pad 8504, a brush, or any device that allows for scrubbing the surface (as in Fig. 8L). In an embodiment as illustrated in Fig. 8L, the scrub pad 8504 may be part of the cleaning pad 8309. The cleaning pad 8309 may be configured to allow the scrub pad 8504 to retract when the scrubber assembly 8500 is in retracted mode 8520 and to engage with the area to be cleaned when the scrubber assembly 8500 is in scrubbing mode 8510. It may be noted that providing a scrub pad 8504 as part of the cleaning pad 8309 may allow for elimination of any alignment issues. For example, if a user puts the cleaning pad 8309 onto the mop head 8300 incorrectly, when the scrubber assembly 8500 is deployed, the scrubber assembly 8500 may potentially come down and rest on top of the cleaning pad 8309 without making any contact with the floor. In a different embodiment, the scrub pad 8504 may be separate from the cleaning pad 8309 and may be removably attached to the second side 8503 of the scrubber base 8501.

[0086] In an exemplary embodiment illustrated in Figs. 8J-8P, the scrubber assembly 8500 may comprise a scrubber base 8501, and a pair of support arms, 8505, and 8506. extending from the scrubber base 8501. The support arms 8505, 8506 may be configured to directly or indirectly connect to the connector assembly 8200 and may at least partially extend into the connector receiving opening. Each of the support arms 8505, 8506 (example, Figs. 8M and 8N, 8O, and 8P) may be configured to be in a folded position when the scrubbing assembly is in a retracted mode 8520 (Mode 1) and in an extended position when the scrubber assembly is in a scrubbing mode 8510 (Mode 2). This embodiment of the scrubber assembly 8500 may offer the benefit of having the scrub pad to not be in contact with the floor when not in scrubbing mode 8510 so as to allow the dirt or grime to not be redeposited on to a clean area.

[0087] In the normal area cleaning mode, where the steam flow is directed to the mop head 8300, the scrubber assembly 8500 is in retracted mode 8520, i.e, away from the area to be cleaned. In steam blast mode of operation 8401, where the steam flow is directed to the steam blast nozzle assembly 8400, the scrubber assembly 8500 is in scrubbing mode 8510, i.e., the support arms 8505, 8506 are extended to allow the scrub member 8504 to be in contact with the area to be cleaned or treated (example, Fig. 8M, Mode 2). This allows for scrubbing the surface in conjunction with the steam blast. In one embodiment, the scrubber base is located adjacent to the steam blast nozzle assembly 8400 so as to allow steam blast to come right before the scrubber is deployed. This allows for efficient removal of the dirt, grime, tough and messy stains on the area to be cleaned.

[0088] In one embodiment, the deployment of the scrubber assembly 8500 may be controlled by the orientation of the mop head 8300 relative to the connector assembly. The angular orientation of the mop head 8300 that allows the steam to be blasted out of the steam blast nozzle assembly 8400 also activates the deployment of the scrubber assembly 8500. The deployment of the scrubber assembly 8500 may also be brought by any means such as a lever mechanism, electrical means etc. As illustrated in Figs. 8M (Mode 1), 8N (Mode 1) and 8O, the scrubber assembly 8500 is in retracted mode 8520 as the mop head 8300 is in the normal area cleaning mode 8303, i.e., in a second position wherein the mop head 8300 is at a second pre-determined angle relative to the connector assembly 8200. As illustrated in Figs. 8M (Mode 2), 8N (Mode 2) and 8P, the scrubber assembly is in scrubbing mode 8510 as the mop head 8300 is in the steam blast mode 8401, i.e., in a first position wherein the mop head 8300 is at a first pre-determined angle relative to the connector assembly 8200.

[0089] Figure 9 depicts an illustrative embodiment of a mop head 9100 that may be used for cleaning or otherwise treating a surface, such as, but not limited to, wood, tile, marble, or laminate flooring. It should be appreciated that the mop head 9100 embodiments described herein may also be used as treatment apparatuses to perform one or more functions other than cleaning to treat or operate on a surface. As illustrated in Figure 9, an embodiment of the mop head 9100 may include a frame 9102, flaps 9104, a joint 9106, and a least one cleaning pad 9108.

[0090] The cleaning pad 9108 may be removably attachable to the flaps 9104. In the embodiment depicted in Figure 10, the cleaning pad 9108 has an interior surface and an exterior surface. In some embodiments, the interior surface of the cleaning pad 9108 has pockets 9110 that can be fitted around protruding portions sections of the flaps 9104 thereby securing the cleaning pad 9108 to the flaps 9104. In some embodiments, the device may comprise a single cleaning pad 9108 that is attached to the flaps 9104. However, in other embodiments the device may comprise a plurality of cleaning pads 9108

that attach to the flaps 9104. In one such embodiment, one pad 9108 attaches to each flap 9104. In different embodiments, there may be different numbers of flaps 9104. In some embodiments, the mop head 9100 may have two faces, and there may be a flap 9104 on each face. In some embodiment, both faces may be used to clean a surface. As can be appreciated, different embodiment may employ different methods to allow the user to switch from using one face of the mop head 9100 or the other.

[0091] It will also be understood by one skilled in the art that other means may be utilized to secure the cleaning pad 9108 to the flaps 9104 as alternatives, or in addition to pockets. For example, in some embodiments, Velcro, or a Velcro-type adhesive, may be used to attach the cleaning pads 9108 to the flaps 9104. But, as can be appreciated, a variety of means may be used to attach the cleaning pad 9108 to the flaps 9104.

[0092] The cleaning pad 9108 may be formed from a variety of materials. Different cleaning pad 9108 embodiments may be appropriate for different types of surface treatments. In some embodiments, different embodiments of the cleaning pad 9108 may be interchangeably attached to the cleaning flaps 9104. For example, a first cleaning pad 9108 embodiment may be attached to flaps 9104 and used and replaced with a second cleaning pad 9108 embodiment to be used for another purpose. In embodiments wherein the treatment head 9100 comprises multiple faces, the cleaning pad 9108 may be divided into sections that correspond to the faces of the treatment head 9100. Each section of the cleaning pad 9108 may be designed for a specific purpose. And, a user can adjust the mop head 9100 so the desired face can be brought to bear on the cleaning surface thereby utilizing the most suitable section of the cleaning pad 9108.

[0093] As illustrated in Figures 11, 11a, 11b, 11c and 11d, in some embodiments the flaps 9104 are pivotably attached to a first portion 9150 of the frame 9102 of the mop head 9100 wherein the flaps 9104 are configured to pivotably rotate relative to the frame 9102 between an open positon and a closed position. The flaps 9104 may be rotated into an open position for attachment and removal of cleaning pads 9108, and locked into a closed position for cleaning. In one embodiment, hinges maybe used to attach the flaps 9104 to the frame 9102.

[0094] However, in alternative embodiments, different attachment mechanisms may be used to attach the flaps 9104 to the frame 9102. The hinge, or other attachment mechanism, used to attach the flaps 9104 to the frame 9102 may be disposed at different locations in different embodiments. In some embodiments, the flaps 9104 may then be rotated about the hinge to an open or closed position. Figure 11 depicts one embodiment of the device with flaps 9104 in an open position. And Figure 12b depicts an embodiment of the device with flaps 9104 in a closed position.

[0095] Figures 11-11d depict embodiments wherein the flaps 9104 are hinged, or pivotably connected to a first side or portion 9150 of the frame 9102 and releasably connected to a second side 9152 of the frame 9102. Such an embodiment allows the flaps 9104 to rotate about the hinge on the first side 9150 so the flaps 9104 may folded into a closed position and releasably connected to the second side 9152 of the frame 9102. For cleaning pad 9108 removal, the flaps 9104 can be folded out into an open position after the flaps 9104 have been released from second side 9152 of the frame. In some embodiments, the first side 9150 and the second side 9152 of the frame 9102 are on opposite, or opposing, sides, as is depicted in the embodiments found in Figures 11-11d.

[0096] In one embodiment, the flaps 9104 are releasably connected to a first side 9150 of the frame 9102, and the joint 9106 is pivotably connected to a second side 9152 of the frame 9102. The first and second sides 9150 and 9152 may oppose each other, in such an embodiment.

[0097] The mop head 9100 embodiments depicted in Figures 12-12h further comprise a first flap 9104A and a second flap 9104B. The first flap 9104A and second flap 9104B are pivotably connected to the first side 9150 of the frame 9102 along a first hinge axis 9200 (for the first flap 9104A), and a second hinge axis 9202 (for the second flap 9104B) that are spaced apart as shown in Figures 12-12h. A variety of locking mechanisms may be utilized in different embodiments to releasably lock the flaps 9104A and 9104B to the frame 9102 at the second side 9152 when they are folded into a closed position. And, different embodiments may utilize different release mechanisms to unlock the flaps 9104A and 9104B from the frame 9102.

[0098] As illustrated in Figures 12-12h, a push button release mechanism 9120 may be used to unlock the flaps 9104A and 9104B so they may be folded open and the cleaning pad 9108 removed. The button 9120 may be located on the frame 9102 of the mop head 9100 in a variety of positions. The button 9120 also may be located at different points on the mop head 9100 or on a cleaning appliance.

[0099] As illustrated in Figures 13-13e, in one embodiment, the cleaning pads 9108 may be configured to include one or more foot tabs 9130. The frame 9102 may be unlocked and the flaps 9104 released when the user puts upward pressure on the frame 9102 and holds the flaps 9104 in place by stepping on the foot tabs 9130. As can be appreciated, the upward pressure may be provided in different ways in different embodiments. However, in many embodiments the mop head 9100 may be attached to a shaft or rod and the user may apply upward pressure on the frame 9102 simply pulling up on the rod or shaft. When a certain pressure is reached, the flaps 9104 will be freed from the locking mechanism and fold open. A user can thus unlock and open the flaps 9104 with touching the mop head 9100 with his or her hands. In some embodiments, the pad 9108 can also be removed in the same motion, and the user may be able to remove the pad 9108 from the flaps 9104 without using

her or her hands. In one such embodiment, the cleaning pad 9108 is attached to the flaps 9104 by pockets 9110. Once the flaps 9104 have unfolded the user can continue to pull on the shaft or rod and pull the flaps 9104 out of the cleaning pad 9108, which will be held to the ground by the foot tab 9130. The pads 9108 can thus be removed, hands free. It will be appreciated that in other embodiments other release mechanisms may be used to release the flaps 9104, some of which are discussed elsewhere in this specification, and including but limited to levers.

[0100] In another embodiment, the cleaning pads 9108 may be attached to the flaps 9104 by Velcro, or other Velcro-type adhesive. The cleaning pads 9108 also may have foot tabs 9130. By stepping on a foot tab 9130 and pulling on the shaft or handle, the user can overcome the grip of the Velcro and detach the mop head 9100 away from the cleaning pad 9108. The mop head 9100 will thus be freed from the cleaning pad 9108, but the flaps 9104 will remain in the closed position. This will allow the user to remove an old, potentially hot, cleaning pad 9108 from the mop head 9100 without touching the cleaning pad with his or her hands. And a new cleaning pad 9108 can then be attached to the mop head 9100.

[0101] In one embodiment, the mop head 9100 may further comprise a connector assembly 9107. In some embodiments, the connector assembly may be used to connect the mop head 9100 to a shaft, handle, or rod. An embodiment of the connector assembly 9106 is depicted in Figures 15-15g . The connector assembly depicted in Figures 15-15g comprises an upper portion 9107A and a lower portion 9107B. The connector assembly 9107 may further comprise a joint 9106 configured to allow the upper portion 9107A and the lower portion 9107B to rotate relative to each other. The lower portion 9107B may comprises a yoke 9160, in some embodiments. The yoke 9160 may be received into recesses 9162 disposed on the frame 9102. In some embodiments, the mop head 9100 can be rotated about the yoke 9160.

[0102] One embodiment of a locking mechanism 9164 is depicted in Figures 15-15g. However, as can be appreciated, alternative means can be used lock or unlock the flaps 9104. In this embodiment the flaps 9104 further comprise catches 9170 extending from the flaps 9104. The locking mechanism 9164 is configured to releasably secure the flaps 9104 in a closed positon. In some embodiments, the locking mechanism 9164 comprises latches 9171 movably connected to the frame 9102. When engaged, the latches 9171 will hold the catches 9170 in place and prevent the flaps 9104 from unfolding. In other embodiments the arrangement and operation of the latches 9171 and catches 9170 in relation to each other are reversed. In such embodiments, the latches 9171 are disposed on the flaps 9104 and the catches are movably connected to the frame 9102. In some embodiments, the latches 9171 can be biased into a first latch position wherein the latches 9171 are engaged. A spring 9172 may be used to bias the latches 9171 into the first latch position. However, in alternative embodiments, different biasing mechanisms may be employed.

[0103] When the latches 9171 are disengaged, the flaps 9104 will be free to fold to an open position. In some embodiments, the latches 9171 may be moved from a first latch position to a second latch position by a trigger 9173. When in the second latch position, the latches 9171 may be disengaged. When in the first latch position wherein the latches 9171 engage the catches 9170 and hold the flaps 9104 in the closed position Some embodiments may comprise a single trigger 9173. But, other embodiments may comprise multiple triggers 9173. Figures 15-15g depict an embodiment with two triggers 9173. When the triggers 9173 are actuated the biasing element 9172 will be compressed and the catches 9170 will be freed from the latches 9171 thereby allowing the flaps 9104 to unfold.

[0104] In the embodiment depicted Figures 15-15c, the triggers 9173 may be actuated by a release mechanism 9174 configured to interact with the locking mechanism 9164. The location of the locking mechanism 9164 may vary in different embodiments. And the interaction between the locking mechanism 9164 and the release mechanism may also vary in different embodiments. The release mechanism 9174 comprises an upper actuator element 9175, and a lower actuator element 9176. In some embodiments, the upper actuator element 9175 is at least partially disposed in the upper portion 9107A of the connector assembly 9107, and the lower actuator element 9176 is at least partially disposed in the lower portion 9107B of the connector assembly 9107. The connector assembly 9107 may be configured so that upper actuator element 9175 and the lower actuator element 9176 do not interfere with the pivoting functionality provided by the joint 9106.

[0105] The upper actuator element 9175 may further comprise an upper edge 9178, and a lower edge 9179. In some embodiments the upper actuator element 9175 may have a first position and a second position. In some embodiments, the upper actuator element 9175 may switch between a first position and second position by a button 9181, as depicted in Figure 15g. As can be appreciated, the button 9181 can be located at different position in different embodiments. In some embodiments, the button 9181 may be engaged by being pressed in a transverse or axial direction. In the first position, the upper edge 9178 protrudes beyond the upper portion 9107A of the connector assembly 9107. And, when in the second position, the lower edge 9179 protrudes from the upper portion 9107A. In some embodiments, a biasing element 9177 will bias the upper edge 9178 and the lower extendible edges into the first position. The push-rod mechanism depicted in Figures 15-15c is in the first position. In some embodiments, the biasing element 9177 comprises a spring. Such an embodiment is depicted in Figures 15-15c. In some embodiments, the upper actuator element 9175 may comprise its own springs to keep in it in the appropriate position

and it does not rely on biasing element 9177.

[0106] In some embodiments the upper actuator element 9175 may be moved from the first position to the second position when pressure is exerted on the upper edge 9178. The upper actuator element 9175 will compress the biasing element 9177. This will cause the upper edge 9178 to retract into the upper assembly 9107A.

[0107] In some embodiments, the lower actuator element 9176 may comprise a lower edge 9180. The lower actuator element 9176 may be movable between a first position and a second position, wherein a lower edge 9180 of the lower actuator 9176 element protrudes from the lower portion 9107B when the lower actuator element 9176 is in the second position.

[0108] The lower edge 9179 of the upper actuator element 9175 may be configured in some embodiments to interact with the lower actuator element 9176 such that the lower actuator element 9176 moves from the first position to the second position when the upper actuator element moves from the first position to the second position of the upper actuator element. In some embodiments, the lower actuator element 9176 may be aligned so that the lower edge 9179 of the upper actuator element 9175 actuates the lower actuator element 9176. Figure 15d depicts an exploded view of the release mechanism 9174 wherein the upper actuator assembly 9175 and the lower actuator assembly 9176 are in second positions. Figures 15-15c depict embodiments wherein the upper actuator element 9175 and lower actuator element 9176 are in first positons.

[0109] The lower edge 9180 of the lower actuator element 9176 may also be configured to interact with the trigger 9173 such that the trigger 9173 would move the latches 9171 from the first latch position to the second latch position when the lower actuator element 9176 moves from the first position to the second position. As mentioned above, the release mechanism 9174 may interact with the locking mechanism 9164 in different ways to trigger the flap 9104 release. In some embodiments the locking mechanism 9164 may be released by axial movement of the lower edge 180. However, in other embodiments, the lower edge 9180 may be configured to move in a transverse direction and thereby triage the release of the locking mechanism.

[0110] In some embodiments, the lower actuator element 9176 may be aligned with the trigger 9173 so that the lower edge 9180 presses the trigger 9173 when the lower edge 9180 protrudes from the lower portion 9107B. This can overcome the biasing element 9172 and free the latches 9171 from the catches 9170.

[0111] As can be appreciated, pressure may be exerted on the upper edge 9178 of the upper actuator element 9175, and move the upper actuator element 9175 from the first positon to the second position, by different ways in different embodiments. In some embodiments, this may be accomplished by pushing down on a rod, shaft, or handle attached to the connector assembly 9107.

[0112] The flaps 9104 may be attached to the base of the frame 9102. But, in other embodiments, the flaps 9104 may be attached at other points on the frame 9102. In one embodiment, there may be two flaps 9104, but in other embodiments there may be a different number of flaps 9104. The flaps 9104 may be manufactured from a variety of materials including but not limited to plastics.

[0113] The frame 9102 may be manufactured from a variety of materials including but not limited to plastic. The frame 9102 may be connected to the joint 9106, which may be configured as a universal joint, as illustrated in Figure 14. The universal joint allows the user freedom to pivot a shaft or handle around the connection point between the frame 9102 and the joint 9106. In embodiments comprising a two-faced mop head 9100 this gives the user the freedom to utilize either face to clean or treat a surface. In some embodiments, the frame 9102 may include recesses 9160 to receive the connector assembly 9107. The connector assembly 9107 may comprise a yoke 9160 that is inserted into the recesses 9162. In some embodiments, the mop head 9100 may be configured to rotate around the yoke 9160 thereby allowing the shaft and handle to pivoted about the connection point. For two-faced embodiments, this gives the user the ability to rotate the mop head 9100 so either face may be applied to a cleaning surface. But, in different embodiments, a variety of means may be used to connect the joint 9106 to the frame 9102.

[0114] In another embodiment, as illustrated in Figures 12c-12h, the frame 9102 may be connected to the joint 9106 by an external support bar 9140. The frame 9102 may have recesses to receive the external support bar 9140. But, as can be appreciated, a variety of means may be used to connect the external support bar 9140 to the frame 9102. This embodiment may also give the user the freedom to pivot a shaft and handle about the connection point between the frame 9102 and the external support bar 9140. And, in embodiments comprising a two-faced mop head 9100 the user has freedom to utilize either face to clean or treat a surface.

[0115] The joint 9106 includes a shaft connection mechanism. As will be appreciated by one skilled in the art, there are numerous connection mechanisms that may be employed in different embodiments to connect the joint 9106 to a shaft or handle. As illustrated in Figure 12, the joint 9106 also may have a swiveling mechanism that gives the user an additional range of motion. As can be appreciated, a variety of means can be employed to give the joint 9106 a swiveling property including but not limited to a pivot.

[0116] Some embodiments of the treatment head 1 may also comprise flap ejectors 9182. One such embodiment is depicted in Figure 16. The flap ejectors 9182 may be configured to pop the flaps 9104 into an open position after the flaps 9104 have been released by the locking mechanism 9164. This will facilitate the opening of the flaps 9104 so a user does not manually have to pull them to an open position after the locking mechanism 9164 has been released. In some embodiments, the flap

ejectors 9182 may comprise a spring biasing the flaps 9104 into the open position. The spring will be compressed when the flaps 9104 are in the closed position, and pop out when the locking mechanism is released. As can be appreciated, different embodiments may comprise different numbers of spring ejectors 9182 and in different locations. And, the flap ejectors 9182 may comprise different forms in different embodiments.

[0117] Some embodiments of the treatment head 9100 may also comprise a linkage element 9183, as depicted in Figure 16. The linkage element 9183 may be configured to connect the flaps 9104 to coordinate the movement of the flaps. In such an embodiment, the flaps 9104 will simultaneously rotate

[0118] In operation a method for using the treatment head 9100 to treat a surface comprising, providing a frame 9102 with a first portion 9150 and pivotably connecting flaps 9104 to the first portion 9150 of the frame 9102 wherein the flaps 9104 are pivotably rotated relative to the frame 9102 into an open position. The method further comprises providing a cleaning pad 9108 and removably attaching the cleaning pad 9108 to the flaps 9104. The method may also comprise providing a locking mechanism 9164 wherein providing the locking mechanism 9164 comprises providing catches 9170 extending from the flaps 9104, movable latches 9171, and a trigger 9173. The flaps 9104 can be rotated into a closed position and locked with the locking mechanism 9164. The method further comprises providing a connection assembly 9107 comprising an upper portion 9107A, a lower portion 9107B, and a joint 9106. The connection assembly is pivotably connected to the frame. A surface is treated with the flaps 9104 locked in a closed position with a cleaning pad 9108 attached by pivoting the treatment head 9100 about the connection assembly 9107 and rotating the upper 9107A and lower portion 9107B relative to each other by the joint 9106, as needed. The method further comprises providing a release mechanism 9174 wherein providing the release mechanism 9174 comprises providing an upper actuator element 9175 at least partially disposed in the upper portion 9107A of the connector assembly 9107, and providing a lower actuator element 9176 at least partially disposed in the lower portion 9107B of the connector assembly 9107. Finally, after the surface is treated, the method comprising releasing the catches 9170 from the latches 9171 by moving the upper actuator element 9175 from a first position to a second positon thereby moving the lower actuator element 9176 from a first position to a second position which engages the trigger 9173

[0119] Fig. 17 shows an embodiment of a surface treatment system 9320 having enhanced swivel and modularized features. In particular, the system 9320 comprises a steam application device 9322 and a portable steamer 9324. The portable steamer 9324 is constructed and arranged to conveniently attach to the steam application device 9322 and detach from the steam application device 9322 (e.g., illustrated by the arrow 9326). The steam application device 9322 includes a main body 9330, a swivel assembly 9332, an applicator 9334, and a mop handle 9336. The main body 9330 includes a first end 9340 which connects directly to the mop handle 9336, a second end 9342 which connects directly to the swivel assembly 9332, and a mid-portion 9344 disposed between the first and second ends 9340, 9342. The swivel assembly 9332 connects the main body 9330 to the applicator 9334, and operates in the manner of a universal joint to allow the main body 9330 and the applicator 9334 to swivel relative to each other.

[0120] As best seen in Fig. 17, the mop handle 9336, the main body 9330, the swivel assembly 9332 and the applicator 9334 are disposed in a sturdy inline configuration which forms a mop 9346 having a central axis 9348. In this configuration, a user, when maneuvering the mop handle 9336, is able to effectively and conveniently clean a surface 9350 with the applicator 9334. With this C-shaped geometry, the main body 9330 cradles the portable steamer 9324 in a manner that robustly and reliably supports the portable steamer 9324 when the portable steamer 9324 is attached to the main body 9330. In some arrangements, the central axis 9348 of the mop 9346 passes through the cavity 9352 (Fig. 17), but the construction of the main body 9330 nevertheless provides sufficient support strength to maintain sturdiness of the mop 9346 and thus enable the user to apply significant mopping force to the surface 9350 for effective cleaning. Furthermore, such geometry enables the portable steamer 9324 to have a relatively large, but modular form factor as well as enables the portable steamer 9324 to detach from the steam application device 9322 in a simple lift away manner, and attach to the steam application device 9322 in a simple insertion manner.

[0121] It is to be appreciated that in a surface treatment system 100 illustrated in Fig. 1A, various combinations of body 200 and mop head 400 could be assembled together to form a surface treatment apparatus. A universal joint 310 may be configured to connect to various combinations of a body 200 and a mop head 400. The body may be any one of the bodies illustrated in Fig. 1B and/or Fig 17. The mop head may be any one of the mop heads illustrated in Figs. 1-17. For example, a surface treatment system in one or more embodiments may allow any combinations below: 1) at least a mop head as illustrated in Figs. 1D in combination with any one of the bodies as in Figs. 1B or Fig. 17; 2) at least a mop head as illustrated in Figs. 2-6 in combination with any one of the bodies as illustrated in Figs. 1B or Fig. 17; 3) at least a mop head as illustrated in Figs. 7-8 in combination with any one of the bodies as illustrated in Figs. 1B or Fig. 17; 4) at least a mop head as illustrated in Figs. 9-16 in combination with any one of the bodies as illustrated in Figs. 1B or Fig. 17, or 5) at least a mop head as in Fig. 17 in combination with any of the bodies as in Figs. 1B or Fig. 17. It is to be noted that the bodies and/or mop heads illustrated in Figs. 1-17 may not be considered to be limiting.

[0122] While various embodiments in accordance with

the disclosed principles have been described above, it should be understood that they have been presented by way of example only, and are not limiting. Thus, the breadth and scope of the example embodiments described herein should not be limited by any of the above-described exemplary embodiments, but should be defined only in accordance with the claims and their equivalents issuing from this disclosure. Furthermore, the above advantages and features are provided in described embodiments, but shall not limit the application of such issued claims to processes and structures accomplishing any or all of the above advantages.

[0123] Words of comparison, measurement, and timing such as "at the time," "equivalent," "during," "complete," and the like should be understood to mean "substantially at the time," "substantially equivalent," "substantially during," "substantially complete," etc., where "substantially" means that such comparisons, measurements, and timings are practicable to accomplish the implicitly or expressly stated desired result. Words relating to relative position of elements such as "about," "near," "proximate to," and "adjacent to" shall mean sufficiently close to have a material effect upon the respective system element interactions.

[0124] Additionally, the section headings herein are provided for consistency with the suggestions under 37 C.F.R. 1.77 or otherwise to provide organizational cues. These headings shall not limit or characterize the invention(s) set out in any claims that may issue from this disclosure. Specifically and by way of example, although the headings refer to a "Technical Field," such claims should not be limited by the language chosen under this heading to describe the so-called technical field. Further, a description of a technology in the "Background" is not to be construed as an admission that technology is prior art to any invention(s) in this disclosure. Neither is the "Summary" to be considered as a characterization of the invention(s) set forth in issued claims. Furthermore, any reference in this disclosure to "invention" in the singular should not be used to argue that there is only a single point of novelty in this disclosure. Multiple inventions may be set forth according to the limitations of the multiple claims issuing from this disclosure, and such claims accordingly define the invention(s), and their equivalents, that are protected thereby. In all instances, the scope of such claims shall be considered on their own merits in light of this disclosure, but should not be constrained by the headings herein.

The following clauses, which are not claims, may define embodiments and/or aspects of the present invention.

1. An apparatus for surface treatment, comprising:

    a steam source;
    a body;
    a mop head; and
    a connector assembly configured to receive steam from the steam source and direct the steam" to the mop head;
    wherein the connector assembly comprises a universal joint and a connector housing connected to the universal joint, wherein a first end portion of the universal joint pivotally connects to the body and a second end portion of the universal joint pivotally connects to the mop head;
    wherein the mop head is configured to rotate about a transverse axis relative to the connector assembly, and the mop head comprises a first and second opposing surfaces, wherein the first and second opposing surfaces are configured to output steam; and
    wherein the mop head is configured to be oriented in first and second positions relative to the connector assembly, wherein:

        when the mop head is in the first position, either one of the first or second opposing surfaces of the mop head is facing upwardly and is oriented at a first predetermined angle relative to the connector assembly; and when the mop head is in the second position, either one of the first or second opposing surfaces of the mop head is facing upwardly and is oriented at a second predetermined angle relative to the connector assembly, wherein the first and second predetermined angles being different.

2. The apparatus of clause 1, wherein the first and second opposing surfaces of the mop head are configured to output steam and the mop head comprises:

    a mop head steam inlet configured to receive steam; and
    a fluid conduit extending from the mop head steam inlet to the first and second opposing surfaces of the mop head, thereby defining at least first and second mop head steam paths to the first and second opposing surfaces of the mop head, respectively.

3. The apparatus of clause 2, further comprising:

    a change-over device disposed at least partially in the fluid conduit of the mop head,
    wherein the change-over device is configured to move between a first change-over device position located along the first mop head steam path and a second change-over device position located along the second mop head steam path;
    wherein, when the mop head is in the second position and the second opposing surface of the mop head is facing upwardly and is oriented at a second predetermined angle relative to the connector assembly, the change-over device is

located in the first change-over device position, thereby blocking the second mop head steam path and allowing steam to be provided through the first mop head steam path and to be output on the first opposing surface of the mop head; and

wherein, when the mop head is in the second position and the first opposing surface of the mop head is facing upwardly and is oriented at a second predetermined angle relative to the connector assembly, the change-over device is located in the second change-over device position, thereby blocking the first mop head steam path and allowing steam to be provided through the second mop head steam path and to be output on the second opposing surface of the mop head.

4. The apparatus of clause 3, wherein the change-over device comprises:

a change-over device body disposed at least partially in the fluid conduit, the change-over device body having a first and second end portions; and

a first and second shoulders extending outwardly from the first and second end portions, respectively;

wherein the first shoulder and the change-over device body are configured to cooperate to block the second mop head steam path when the change-over device is in the first change-over device position; and

wherein the second shoulder and the change-over device body are configured to cooperate to block the first mop head steam path when the change-over device is in the second change-over device position.

5. The apparatus of clause 4, wherein the first shoulder comprises a sealing element disposed on a shoulder surface facing the second shoulder, and the second shoulder comprises a sealing element disposed on a shoulder surface facing the first shoulder.

6. The apparatus of clause 5, wherein the change-over device comprises a ball valve comprising a sealing element disposed in a cavity defined in the fluid conduit, the sealing element configured to move between the first change-over device position located along the first mop head steam path and the second change-over device position located along the second mop head steam path.

7. The apparatus of clause 1, wherein the first and second opposing surfaces of the mop head are configured to output steam and the mop head further comprises:

a mop head steam inlet configured to receive steam;

a first and second steam chambers defined in the mop head on the first and second opposing surfaces of the mop head, respectively;

a fluid conduit extending from the mop head steam inlet of the mop head into the first and second steam chambers,

wherein the fluid conduit and the first steam chamber define a first mop head steam path, and the fluid conduit and the second steam chamber define a second mop head steam path; and

a change-over device configured to move between a first and a second change-over device positions in the mop head,

wherein, when the mop head is in the second position and the second opposing surface of the mop head is facing upwardly and is oriented at a second predetermined angle relative to the connector assembly, the change-over device is located in the first change-over device position, thereby blocking the second mop head steam path and allowing steam to be provided through the first mop head steam path to the first steam chamber so as to be output on the first opposing surface of the mop head, and

wherein, when the mop head is in the second position and the first opposing surface of the mop head is facing upwardly and is oriented at a second predetermined angle relative to the connector assembly, the change-over device is located in the second change-over device position, thereby blocking the first mop head steam path and allowing steam to be provided through the second mop head steam path to the second steam chamber so as to be output on the second opposing surface of the mop head.

8. The apparatus of clause 1, wherein:

the body comprises a pivoting steam vent; and

the mop head comprises:

a first steam chamber comprising a first steam chamber inlet, the first steam chamber configured to output steam on the first opposing surface of the mop head; and

a second steam chamber comprising a second steam chamber inlet, the second steam chamber configured to output steam on the second opposing surface of the mop head,

wherein when the mop head is in the second position with the second opposing surface facing upwardly, the first steam chamber inlet is configured to align with the pivoting

steam vent of the body, thereby allowing steam to be provided to the first steam chamber and to be output on the first opposing surface of the mop head, and

wherein when the mop head is in the second position with the first opposing surface facing upwardly, the second steam chamber inlet is configured to align with the pivoting steam vent of the body, thereby allowing steam to be provided to the second steam chamber and to be output on the second opposing surface of the mop head.

9. The apparatus of clause 1, wherein the connector housing comprises:

a connector steam inlet configured to receive steam from the steam source;

a connector steam conduit defining at least a first and second connector steam paths, wherein the first and second connector steam paths are configured to direct steam from the connector steam inlet; and

a steam blast nozzle assembly disposed at least partially in the first connector steam path;

wherein:

when the mop head is oriented at a first predetermined angle relative to the connector assembly, a steam flow is directed through the first connector steam path to the steam blast nozzle assembly, thereby allowing the steam to be discharged in a steam blast mode, and

when the mop head is oriented at a second predetermined angle relative to the connector assembly, a steam flow is directed through the second connector steam path to the mop head, thereby allowing the steam to be discharged in an area cleaning mode.

10. The apparatus of clause 9, wherein the steam blast nozzle assembly comprises a nozzle inlet portion, a nozzle middle portion, and a nozzle outlet portion.

11. The apparatus of clause 10, wherein the nozzle inlet portion of the steam blast nozzle assembly defines a first cross-sectional surface area, the nozzle middle portion defines a second cross-sectional surface area, the nozzle outlet portion defines a third cross-sectional surface area, wherein the second cross-sectional surface area is smaller than the first and third cross-sectional surface areas.

12. The apparatus of clause 11, wherein the nozzle outlet portion of the steam blast nozzle assembly comprises a conical shaped nozzle outlet portion; wherein the conical shaped nozzle outlet portion produces a conical shaped steam blast profile.

13. The apparatus of clause 9, wherein the connector housing further defines a valve mechanism configured to switchably direct a steam flow through the first connector steam path to the steam blast nozzle assembly or the second connector steam path to the mop head, wherein the valve mechanism defines at least a portion of the first connector steam path or at least a portion of the second connector steam path or both.

14. The apparatus of clause 13, wherein the valve mechanism is configured to define a first baffle and a second baffle;

wherein the first baffle and the second baffle cooperate to form at least a portion of the first connector steam path or at least a portion of the second connector steam path depending on relative movement of the first and second baffles;

wherein the first and second baffles have a first relative movement when the mop head is oriented at a first predetermined angle relative to the connector assembly and a second relative movement when the mop head is oriented at a second predetermined angle relative to the connector assembly;

wherein upon first relative movement of the first and the second baffle members, the second connector steam path is blocked, and wherein upon second relative movement the first and the second baffle members, the first connector steam path is blocked.

15. The apparatus of clause 13, wherein the first and second opposing surfaces of the mop head are configured to output steam and the mop head further comprises:

a change-over device configured to move between a first and a second change-over device positions in the mop head,

wherein, when the mop head is in the second position and the second opposing surface of the mop head is facing upwardly and is oriented at a second predetermined angle relative to the connector assembly, the change-over device is located in the first change-over device position, thereby allowing steam to be output only on the first opposing surface of the mop head, and

wherein, when the mop head is in the second position and the first opposing surface of the mop head is facing upwardly and is oriented at a second predetermined angle relative to the connector assembly, the change-over device is located in the second change-over device posi-

tion, thereby allowing steam to be output only on the second opposing surface of the mop head.

16. The apparatus of clause 1, wherein the first predetermined angle is an acute angle, and the second predetermined angle is an obtuse angle.

17. An apparatus for surface treatment, comprising:

a steam source;
a body;
a mop head; and
a connector assembly configured to receive steam from the steam source;
wherein the connector assembly comprises a universal joint and a connector housing connected to the universal joint, wherein a first end portion of the universal joint pivotally connects to the body and a second end portion of the universal joint pivotally connects to the mop head;
wherein the mop head is configured to rotate about a transverse axis relative to the connector assembly, and the mop head comprises a mop head housing, and a first and second opposing surfaces, wherein only the second opposing surface is configured to output steam; and
wherein the mop head is configured to be oriented in first and second positions relative to the connector assembly, wherein:

when the mop head is in the first position, the mop head is oriented at a first predetermined angle relative to the connector assembly, and the connector assembly is configured to output steam in a steam blast mode; and
when the mop head is in the second position, the mop head is oriented at a second predetermined angle relative to the connector assembly, the first and second predetermined angles being different, and the connector assembly is configured to direct steam to the mop head where the steam would be discharged therefrom in an area cleaning mode.

18. The apparatus of clause 17, wherein the connector housing comprises:

a connector steam inlet configured to receive steam from the steam source;
a connector steam conduit defining at least a first and second connector steam paths, wherein the first and second connector steam paths are configured to direct steam from the connector steam inlet; and
a steam blast nozzle assembly disposed at least partially in the first connector steam path;
wherein:

when the mop head is oriented at a first predetermined angle relative to the connector assembly, a steam flow is directed through the first connector steam path to the steam blast nozzle assembly, thereby allowing the steam to be discharged in the steam blast mode, and
when the mop head is oriented at a second predetermined angle relative to the connector assembly, a steam flow is directed through the second connector steam path to the mop head, thereby allowing the steam to be discharged in the area cleaning mode.

19. The apparatus of clause 18, wherein the steam blast nozzle assembly comprises a nozzle inlet portion, a nozzle middle portion, and a nozzle outlet portion.

20. The apparatus of clause 19, wherein the nozzle inlet portion of the steam blast nozzle assembly defines a first cross-sectional surface area, the nozzle middle portion defines a second cross-sectional surface area, the nozzle outlet portion defines a third cross-sectional surface area, wherein the second cross-sectional surface area is smaller than the first and third cross-sectional surface areas.

21. The apparatus of clause 20, wherein the nozzle outlet portion of the steam blast nozzle assembly comprises a conical shaped nozzle outlet portion.

22. The apparatus of clause 18, wherein the connector housing further defines a valve mechanism configured to switchably direct a steam flow through the first connector steam path to the steam blast nozzle assembly or the second connector steam path to the mop head, wherein the valve mechanism defines at least a portion of the first connector steam path or at least a portion of the second connector steam path or both.

23. The apparatus of clause 22, further comprising a scrubber assembly,

wherein the scrubber assembly comprises a scrubbing mode and a retracted mode;
wherein:

when the scrubber assembly is in the scrubbing mode, the scrubber assembly moves to engage with an area to be cleaned; and
when the scrubber assembly is in the retracted state, the scrubber assembly moves to disengage from the area.

24. The apparatus of clause 23, wherein:

when the mop head is in first position, the steam blast mode is activated and the scrubber assembly is configured to be in scrubbing mode; and
when the mop head is in second position, the area cleaning mode is activated and the scrubber assembly is configured to be in retracted mode.

25. A method for surface treatment, comprising:

providing a steam source;
providing a body;
providing a mop head; and
providing a connector assembly, wherein the connector assembly is configured to receive steam from the steam source;
wherein the connector assembly comprises a universal joint and a connector housing connected to the universal joint, wherein a first end portion of the universal joint pivotally connects to the body and a second end portion of the universal joint pivotally connects to the mop head;
wherein the mop head is configured to rotate about a transverse axis relative to the connector assembly, and the mop head comprises a first and second opposing surfaces, wherein either the first or second or both opposing surfaces being configured to output steam; and
wherein the mop head is configured to be oriented in first and second positions relative to the connector assembly, wherein:

when the mop head is in the first position, the first or second opposing surfaces is facing upwardly and the mop head is oriented at a first predetermined angle relative to the connector assembly, and the connector assembly is configured to output steam in a steam blast mode; and
when the mop head is in the second position, the first or second opposing surfaces is facing upwardly and the mop head is oriented at a second predetermined angle relative to the connector assembly, the first and second predetermined angles being different, and the connector assembly is configured to direct steam to the mop head where the steam would be discharged therefrom in an area cleaning mode.

26. The method of clause 25, further comprising:
providing a connector housing, wherein the connector housing comprises:

a connector steam inlet, wherein the connector steam inlet is configured to receive steam from the steam source;
a connector steam conduit defining at least a first and second connector steam paths, wherein the first and second connector steam paths are configured to direct steam from the connector steam inlet; and
a steam blast nozzle assembly disposed at least partially in the first connector steam path;
wherein:

when the mop head is oriented at a first predetermined angle relative to the connector assembly, a steam flow is directed through the first connector steam path to the steam blast nozzle assembly, thereby allowing the steam to be discharged in the steam blast mode, and
when the mop head is oriented at a second predetermined angle relative to the connector assembly, a steam flow is directed through the second connector steam path to the mop head, thereby allowing the steam to be discharged in the area cleaning mode.

27. The method of clause 26, wherein the connector housing further defines a valve mechanism configured to switchably direct a steam flow through the first connector steam path to the steam blast nozzle assembly or the second connector steam path to the mop head, wherein the valve mechanism defines at least a portion of the first connector steam path or at least a portion of the second connector steam path or both.

28. The method of clause 26, further comprising:
providing a scrubber assembly, wherein:

the scrubber assembly is configured to be connected to the connector assembly,
wherein the scrubber assembly comprises a scrubbing mode and a retracted mode;
wherein:

when the scrubber assembly is in the scrubbing mode, the scrubber assembly moves to engage with an area to be cleaned; and
when the scrubber assembly is in the retracted state, the scrubber assembly moves to disengage from the area.

29. The method of clause 28, wherein:

when the steam blast mode is activated, the scrubber assembly is configured to be in scrubbing mode; and
when the area cleaning mode is activated, the scrubber assembly is configured to be in retracted mode.

30. A mop head, comprising:

a frame comprising:
a first portion;
flaps pivotably connected to the first portion of the frame wherein the flaps are configured to pivotably rotate relative to the frame between an open position and a closed position;

a connector assembly pivotably connected to the frame comprising:

an upper portion;
a lower portion; and

a joint configured to allow the upper portion and the lower portion to rotate relative to each other;
a locking mechanism configured to releasably secure the flaps in the closed position and comprising:
a trigger configured to release the flaps from the closed position, when actuated.

31. The apparatus of clause 30, wherein the mop head further comprises cleaning pads removably attachable to the flaps.

32. The apparatus of clause 30, wherein:

the flaps further comprise catches extending therefrom;
the locking mechanism further comprises latches movably connected to the frame; and
wherein the trigger, when actuated, is configured to release the flaps from the closed position by moving the latches from a first latch position to a second latch position wherein the latches engage the catches when in the first latch position and hold the flaps in the closed position and wherein the latches are disengaged from the catches when in the second latch position.

33. The apparatus of clause 30, wherein:

the flaps further comprise latches extending therefrom;
the locking mechanism further comprises catches movably connected to the frame; and
wherein the trigger, when actuated, is configured to release the flaps from the closed position by moving the catches from a first catch position to a second catch position wherein the catches engage the latches when in the first catch position and hold the flaps in the closed position and wherein the catches are disengaged from the latches when in the second catch position.

34. The apparatus of clause 30, wherein the frame further comprises flap ejectors that are configured to eject the flaps from the closed position to the open position when the flaps are released by the locking mechanism.

35. The apparatus of clause 30, wherein the flap ejectors comprise spring-loaded biasing elements.

36. The apparatus of clause 30, further comprising:
a release mechanism configured to interact with the locking mechanism, the release mechanism comprising:

an upper actuator element at least partially disposed in the upper portion of the connector assembly;
a lower actuator element at least partially disposed in the lower portion of the connector assembly;
wherein the upper actuator element is configured to engage the lower actuator element and the lower actuator element is configured to engage the trigger to release the flaps from the closed position.

37. The apparatus of clause 36, wherein the release mechanism is actuated by a button.

38. The apparatus of clause 30, further comprising:
a release mechanism configured to interact with the locking mechanism, the release mechanism comprising:

an upper actuator element at least partially disposed in the upper portion of the connector assembly, the upper actuator element movable between a first position and a second position by a button, wherein a lower edge of the upper actuator element protrudes from the upper portion when the upper actuator element is in the second position;
a lower actuator element at least partially disposed in the lower portion of the connector assembly, the lower actuator element movable between a first position and a second position, wherein a lower edge of the lower actuator element protrudes from the lower portion when the lower actuator element is in the second position;
wherein the lower edge of the upper actuator element is configured to interact with the lower actuator element such that the lower actuator element would move from the first position to the second position when the upper actuator element moves from the first position to the second position of the upper actuator element; and
wherein the lower edge of the lower actuator element is configured to interact with the trigger such that the trigger releases the flaps from the

closed position.

39. The apparatus of clause 30, further comprising: a release mechanism configured to interact with the locking mechanism, the release mechanism comprising:

an upper actuator element at least partially disposed in the upper portion of the connector assembly, the upper actuator element movable between a first position and a second position, wherein an upper edge of the upper actuator element protrudes beyond the upper portion when the upper actuator element is in the first position, and wherein a lower edge of the upper actuator element protrudes from the upper portion when the upper actuator element is in the second position;
a lower actuator element at least partially disposed in the lower portion of the connector assembly, the lower actuator element movable between a first position and a second position, wherein a lower edge of the lower actuator element protrudes from the lower portion when the lower actuator element is in the second position;
wherein the lower edge of the upper actuator element is configured to interact with the lower actuator element such that the lower actuator element would move from the first position to the second position when the upper actuator element moves from the first position to the second position of the upper actuator element; and
wherein the lower edge of the lower actuator element is configured to interact with the trigger such that the trigger releases the flaps from the closed position.

40. The apparatus of clause 30 further comprising a linkage element that links the flaps together; and wherein the flaps are configured to simultaneously rotate between the open position and the closed positions.

41. A method for treating a surface, the method comprising:

providing a frame with a first portion;
pivotably connecting flaps to the first portion of the frame wherein the flaps are pivotably rotated relative to the frame into an open position;
providing a cleaning pad and removably attaching the cleaning pad to the flaps;
providing a locking mechanism wherein providing the locking mechanism comprises providing catches extending from the flaps, movable latches, and a trigger;
rotating the flaps into a closed positon and locking them in place with the locking mechanism;
providing a connection assembly comprising an upper portion, a lower portion, and a joint;
pivotably connecting the connection assembly to the frame;
treating a surface with the mop head and pivoting the treatment head about the connection and rotating the upper and lower portion relative to each other by the joint, as needed;
providing a release mechanism wherein providing the release mechanisms comprises providing:

an upper actuator element at least partially disposed in the upper portion of the connector assembly;
a lower actuator element at least partially disposed in the lower portion of the connector assembly;

releasing the catches from the latches by moving the upper actuator element from a first position to a second positon thereby moving the lower actuator element from a first position to a second position which engages the trigger.

42. An apparatus for surface treatment, comprising:

a steam source;
a body;
a mop head; and
a connector assembly configured to receive steam from the steam source;
wherein the connector assembly comprises a universal joint and a connector housing connected to the universal joint, wherein a first end portion of the universal joint pivotally connects to the body and a second end portion of the universal joint pivotally connects to the mop head;
wherein the mop head is configured to rotate about a transverse axis relative to the connector assembly, and the mop head comprises a mop head housing, and a first and second opposing surfaces, wherein only the second opposing surface is configured to output steam; and wherein the mop head is configured to be oriented in first and second positions relative to the connector assembly, wherein:

when the mop head is in the first position, the mop head is oriented at a first predetermined angle relative to the connector assembly, and the connector assembly is configured to output steam in a steam blast mode; and
when the mop head is in the second position, the mop head is oriented at a second predetermined angle relative to the connector assembly, the first and second predeter-

mined angles being different, and the connector assembly is configured to direct steam to the mop head where the steam would be discharged therefrom in an area cleaning mode.

43. The apparatus of clause 42, wherein the connector housing comprises:

a connector steam inlet configured to receive steam from the steam source;
a connector steam conduit defining at least a first and second connector steam paths, wherein the first and second connector steam paths are configured to direct steam from the connector steam inlet; and
a steam blast nozzle assembly disposed at least partially in the first connector steam path; wherein:

when the mop head is oriented at a first predetermined angle relative to the connector assembly, a steam flow is directed through the first connector steam path to the steam blast nozzle assembly, thereby allowing the steam to be discharged in the steam blast mode, and
when the mop head is oriented at a second predetermined angle relative to the connector assembly, a steam flow is directed through the second connector steam path to the mop head, thereby allowing the steam to be discharged in the area cleaning mode.

44. The apparatus of clause 43, wherein the steam blast nozzle assembly comprises a nozzle inlet portion, a nozzle middle portion, and a nozzle outlet portion.

45. The apparatus of clause 44, wherein the nozzle inlet portion of the steam blast nozzle assembly defines a first cross-sectional surface area, the nozzle middle portion defines a second cross-sectional surface area, the nozzle outlet portion defines a third cross-sectional surface area, wherein the second cross-sectional surface area is smaller than the first and third cross-sectional surface areas.

46. The apparatus of clause 45, wherein the nozzle outlet portion of the steam blast nozzle assembly comprises a conical shaped nozzle outlet portion.

47. The apparatus of clause 43, wherein the connector housing further defines a valve mechanism configured to switchably direct a steam flow through the first connector steam path to the steam blast nozzle assembly or the second connector steam path to the mop head, wherein the valve mechanism defines at least a portion of the first connector steam path or at least a portion of the second connector steam path or both.

48. The apparatus of clause 47, further comprising a scrubber assembly,

wherein the scrubber assembly comprises a scrubbing mode and a retracted mode;
wherein:

when the scrubber assembly is in the scrubbing mode, the scrubber assembly moves to engage with an area to be cleaned; and
when the scrubber assembly is in the retracted state, the scrubber assembly moves to disengage from the area.

49. The apparatus of clause 48, wherein:

when the mop head is in first position, the steam blast mode is activated and the scrubber assembly is configured to be in scrubbing mode; and
when the mop head is in second position, the area cleaning mode is activated and the scrubber assembly is configured to be in retracted mode.

50. A method for surface treatment, comprising:

providing a steam source;
providing a body;
providing a mop head; and
providing a connector assembly, wherein the connector assembly is configured to receive steam from the steam source;
wherein the connector assembly comprises a universal joint and a connector housing connected to the universal joint, wherein a first end portion of the universal joint pivotally connects to the body and a second end portion of the universal joint pivotally connects to the mop head;
wherein the mop head is configured to rotate about a transverse axis relative to the connector assembly, and the mop head comprises a first and second opposing surfaces,
wherein either the first or second or both opposing surfaces being configured to output steam; and
wherein the mop head is configured to be oriented in first and second positions relative to the connector assembly, wherein:

when the mop head is in the first position, the first or second opposing surfaces is facing upwardly and the mop head is oriented at a first predetermined angle relative to the connector assembly, and the connector as-

sembly is configured to output steam in a steam blast mode; and
when the mop head is in the second position, the first or second opposing surfaces is facing upwardly and the mop head is oriented at a second predetermined angle relative to the connector assembly, the first and second predetermined angles being different, and the connector assembly is configured to direct steam to the mop head where the steam would be discharged therefrom in an area cleaning mode.

51. The method of clause 50, further comprising:
providing a connector housing, wherein the connector housing comprises:

a connector steam inlet, wherein the connector steam inlet is configured to receive steam from the steam source;
a connector steam conduit defining at least a first and second connector steam paths, wherein the first and second connector steam paths are configured to direct steam from the connector steam inlet; and
a steam blast nozzle assembly disposed at least partially in the first connector steam path; wherein:

when the mop head is oriented at a first predetermined angle relative to the connector assembly, a steam flow is directed through the first connector steam path to the steam blast nozzle assembly, thereby allowing the steam to be discharged in the steam blast mode, and
when the mop head is oriented at a second predetermined angle relative to the connector assembly, a steam flow is directed through the second connector steam path to the mop head, thereby allowing the steam to be discharged in the area cleaning mode.

52. The method of clause 51, wherein the connector housing further defines a valve mechanism configured to switchably direct a steam flow through the first connector steam path to the steam blast nozzle assembly or the second connector steam path to the mop head, wherein the valve mechanism defines at least a portion of the first connector steam path or at least a portion of the second connector steam path or both.

53. The method of clause 51, further comprising:
providing a scrubber assembly, wherein:

the scrubber assembly is configured to be connected to the connector assembly, wherein the scrubber assembly comprises a scrubbing mode and a retracted mode;
wherein:

when the scrubber assembly is in the scrubbing mode, the scrubber assembly moves to engage with an area to be cleaned; and
when the scrubber assembly is in the retracted state, the scrubber assembly moves to disengage from the area.

54. The method of clause 53, wherein:

when the steam blast mode is activated, the scrubber assembly is configured to be in scrubbing mode; and
when the area cleaning mode is activated, the scrubber assembly is configured to be in retracted mode.

55. A mop head, comprising:

a frame comprising:
a first portion;
flaps pivotably connected to the first portion of the frame wherein the flaps are configured to pivotably rotate relative to the frame between an open position and a closed position;
a connector assembly pivotably connected to the frame comprising:

an upper portion;
a lower portion; and
a joint configured to allow the upper portion and the lower portion to rotate relative to each other;

a locking mechanism configured to releasably secure the flaps in the closed position and comprising:
a trigger configured to release the flaps from the closed position, when actuated.

56. A method for treating a surface, the method comprising:

providing a frame with a first portion;
pivotably connecting flaps to the first portion of the frame wherein the flaps are pivotably rotated relative to the frame into an open position;
providing a cleaning pad and removably attaching the cleaning pad to the flaps; providing a locking mechanism wherein providing the locking mechanism comprises providing catches extending from the flaps, movable latches, and a trigger;
rotating the flaps into a closed position and locking them in place with the locking mechanism;

providing a connection assembly comprising an upper portion, a lower portion, and a joint;
pivotably connecting the connection assembly to the frame;
treating a surface with the mop head and pivoting the treatment head about the connection and rotating the upper and lower portion relative to each other by the joint, as needed;
providing a release mechanism wherein providing the release mechanisms comprises providing:

an upper actuator element at least partially disposed in the upper portion of the connector assembly;
a lower actuator element at least partially disposed in the lower portion of the connector assembly;
releasing the catches from the latches by moving the upper actuator element from a first position to a second position thereby moving the lower actuator element from a first position to a second position which engages the trigger.

Claims

1. A mop head, comprising a frame including flaps pivotably connected to the frame so as to rotate relative to the frame between an open position and a closed position;

a connector assembly pivotably connected to the frame and comprising

an upper portion,
a lower portion, and
a joint configured to allow the upper portion and the lower portion to rotate relative to each other; and

a locking mechanism configured to releasably secure the flaps in the closed position and including a trigger configured to release the flaps from the closed position, when actuated.

2. The mop head of claim 0, further comprising cleaning pads removably attachable to the flaps.

3. The mop head of claim 0, wherein:

the flaps further comprise catches extending therefrom,
the locking mechanism further comprises latches movably connected to the frame, and
the trigger, when actuated, is configured to release the flaps from the closed position by moving the latches from a first latch position to a second latch position, wherein the latches engage the catches when in the first latch position and hold the flaps in the closed position and wherein the latches are disengaged from the catches when in the second latch position.

4. The mop head of claim 0, wherein:

the flaps further comprise latches extending therefrom,
the locking mechanism further comprises catches movably connected to the frame, and
the trigger, when actuated, is configured to release the flaps from the closed position by moving the catches from a first catch position to a second catch position, wherein the catches engage the latches when in the first catch position and hold the flaps in the closed position, and wherein the catches are disengaged from the latches when in the second catch position.

5. The mop head of claim 0, wherein the frame further comprises flap ejectors that are configured to eject the flaps from the closed position to the open position when the flaps are released by the locking mechanism.

6. The mop head of claim 0, wherein the flap ejectors comprise spring-loaded biasing elements.

7. The mop head of claim 0, further comprising:
a release mechanism configured to interact with the locking mechanism, the release mechanism comprising:

an upper actuator element at least partially disposed in the upper portion of the connector assembly,
a lower actuator element at least partially disposed in the lower portion of the connector assembly,
wherein the upper actuator element is configured to engage the lower actuator element and the lower actuator element is configured to engage the trigger to release the flaps from the closed position; and
optionally or preferably wherein the release mechanism is actuated by a button.

8. The mop head of claim 0, further comprising:
a release mechanism configured to interact with the locking mechanism, the release mechanism comprising:

an upper actuator element at least partially disposed in the upper portion of the connector assembly and movable by a button between a first

position and a second position, and
a lower actuator element at least partially disposed in the lower portion of the connector assembly, the lower actuator element movable between a first position and a second position.

9. The mop head of claim 8, wherein a lower edge of the upper actuator element protrudes from the upper portion when the upper actuator element is in the second position; and
optionally or preferably, wherein the lower edge of the upper actuator element is configured to interact with the lower actuator element such that the lower actuator element would move from the first position to the second position when the upper actuator element moves from the first position to the second position of the upper actuator element.

10. The mop head of claim 8, wherein a lower edge of the lower actuator element protrudes from the lower portion when the lower actuator element is in the second position; and
optionally or preferably wherein the lower edge of the lower actuator element is configured to interact with the trigger such that the trigger releases the flaps from the closed position.

11. The mop head of claim 0, further comprising:
a release mechanism configured to interact with the locking mechanism, the release mechanism comprising:

an upper actuator element at least partially disposed in the upper portion of the connector assembly, the upper actuator element movable between a first position and a second position, and
a lower actuator element at least partially disposed in the lower portion of the connector assembly, the lower actuator element movable between a first position and a second position.

12. The mop head of claim 11, wherein an upper edge of the upper actuator element protrudes beyond the upper portion when the upper actuator element is in the first position.

13. The mop head of claim 11, wherein a lower edge of the upper actuator element protrudes from the upper portion when the upper actuator element is in the second position; and
optionally or preferably wherein the lower edge of the upper actuator element is configured to interact with the lower actuator element such that the lower actuator element would move from the first position to the second position when the upper actuator element moves from the first position to the second position of the upper actuator element.

14. The mop head of claim 11, wherein a lower edge of the lower actuator element protrudes from the lower portion when the lower actuator element is in the second position; and
optionally or preferably, wherein the lower edge of the lower actuator element is configured to interact with the trigger such that the trigger releases the flaps from the closed position.

15. The mop head of claim 0, further comprising a linkage element linking the flaps together such that the flaps simultaneously rotate between the open position and the closed position.

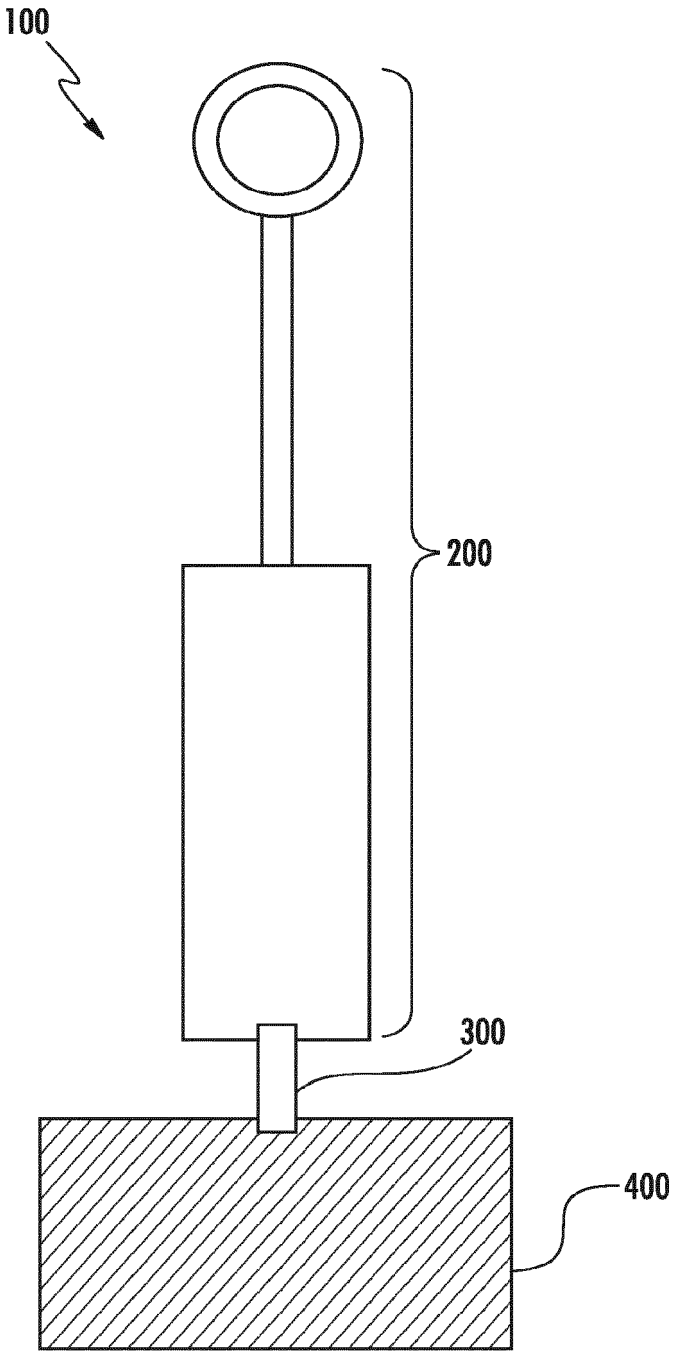


FIG. 1A

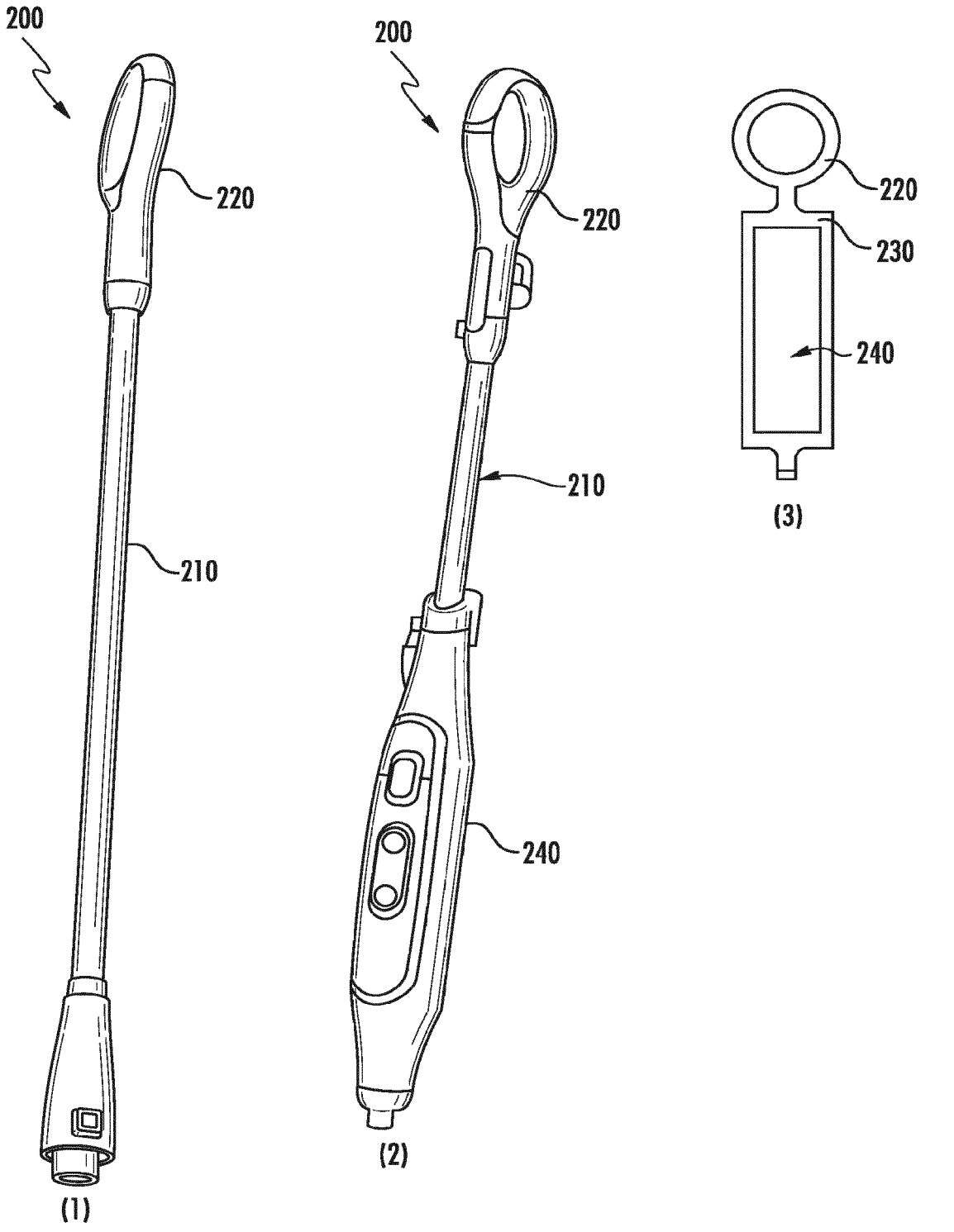


FIG. 1B

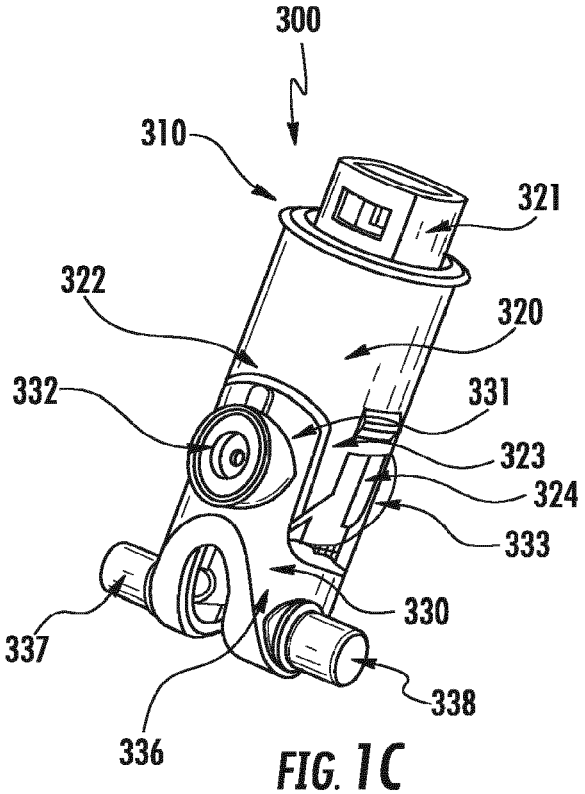
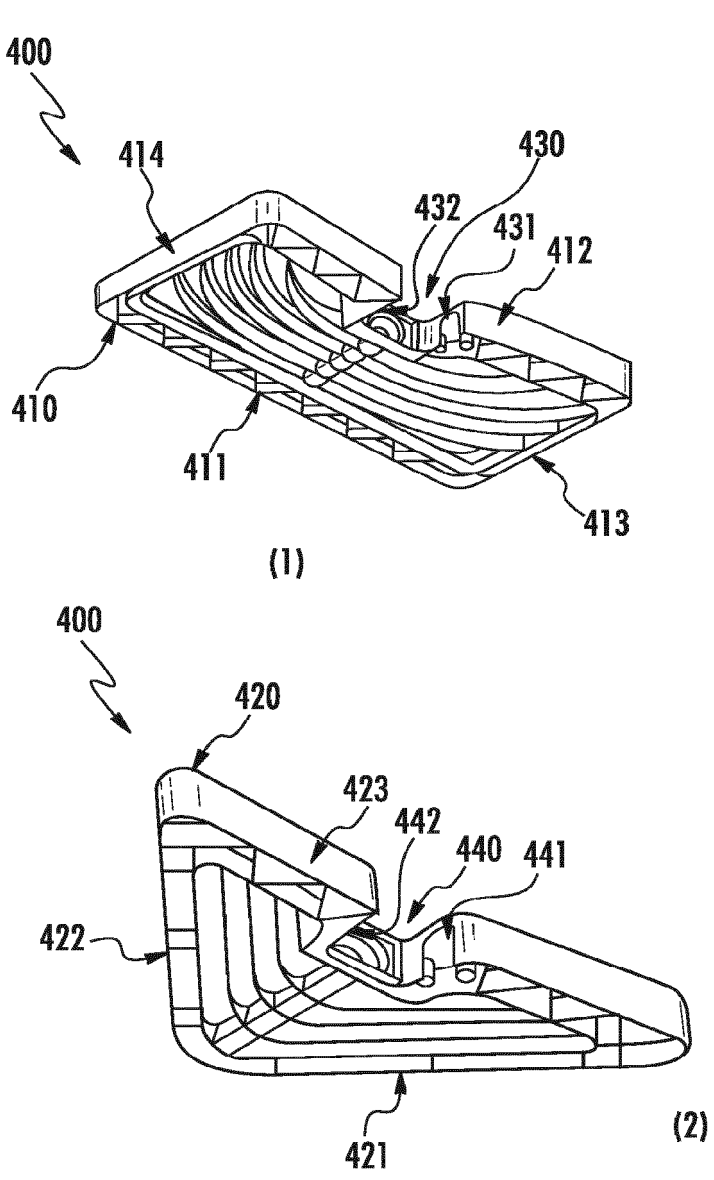


FIG. 1C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422
421
(2)

FIG. 1D

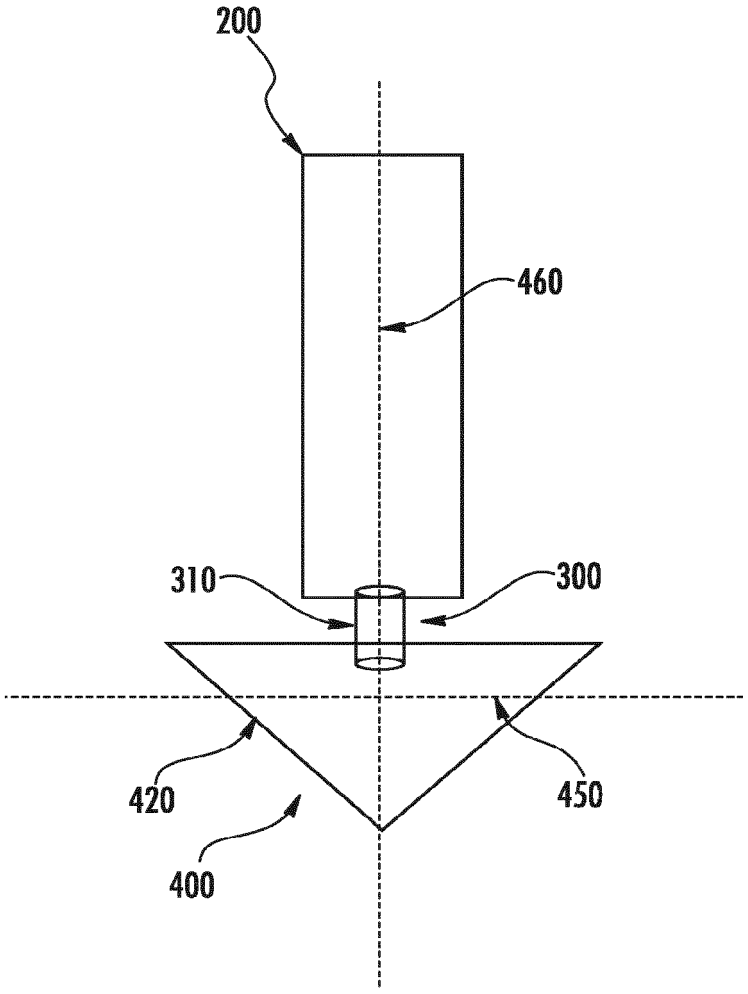

FIG. 1E

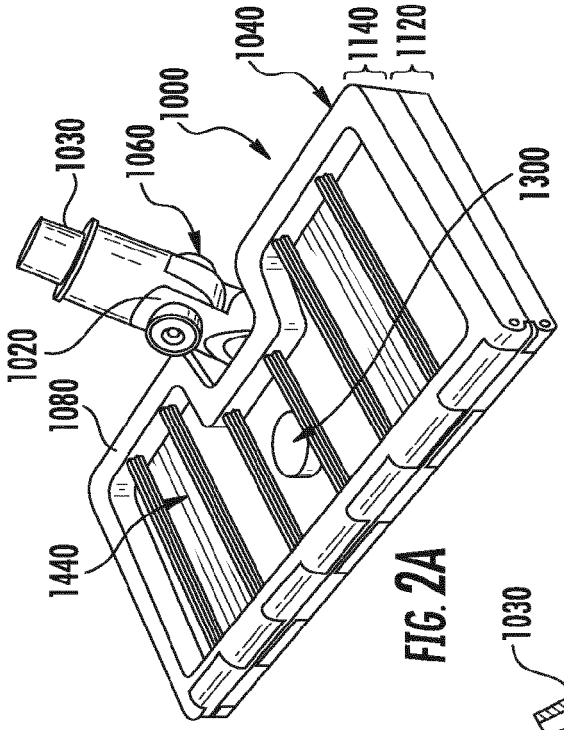

FIG. 2A

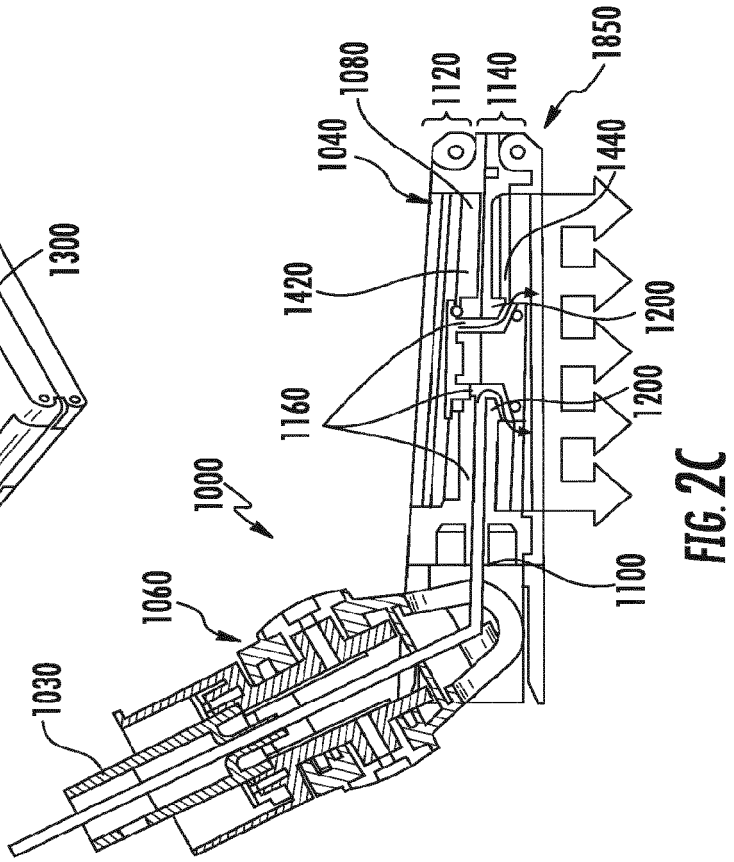

FIG. 2C

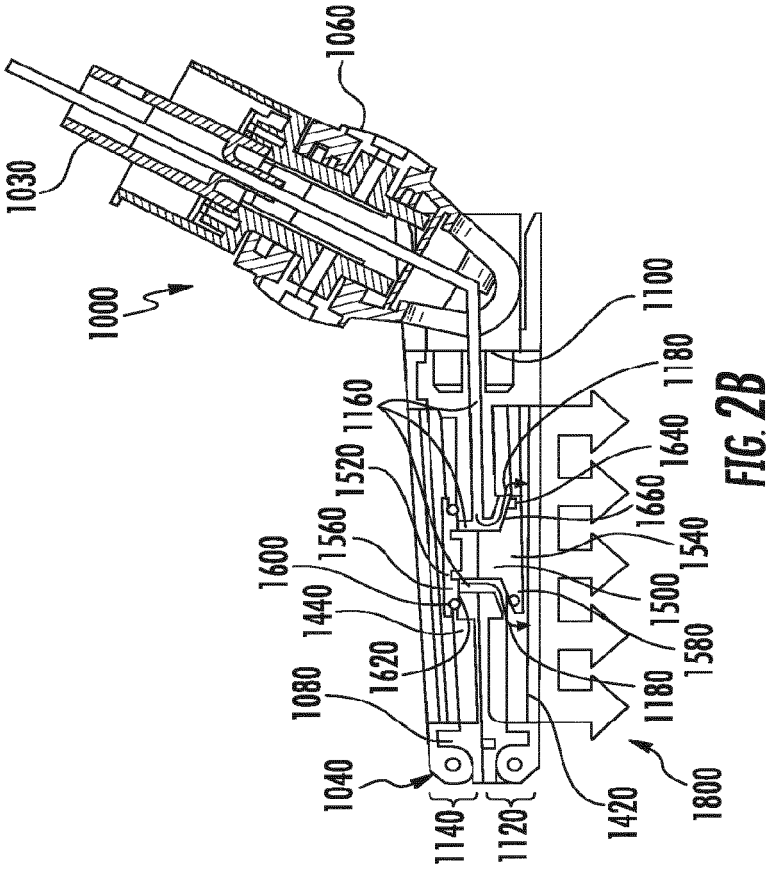

FIG. 2B

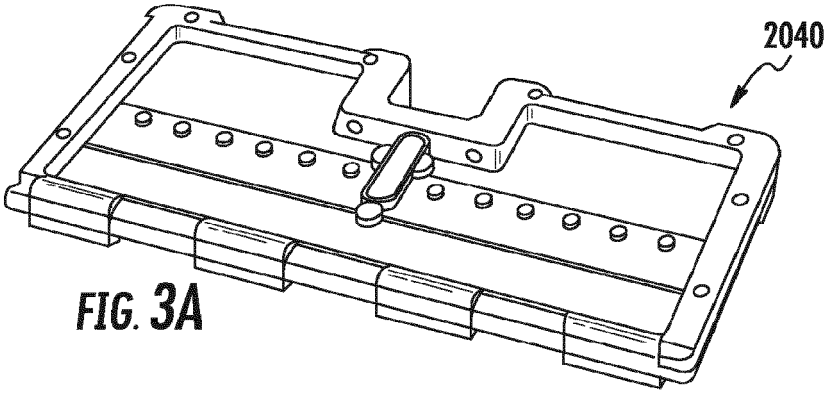

FIG. 3A

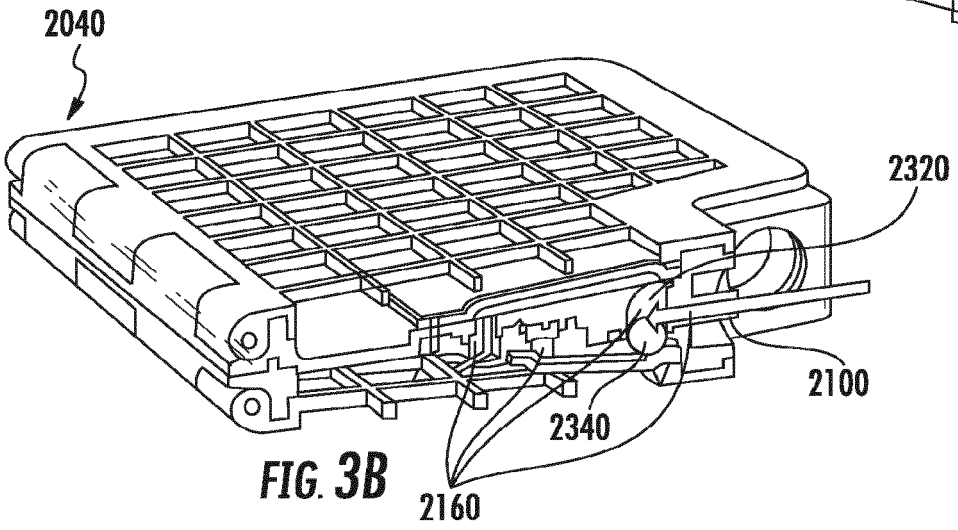

FIG. 3B

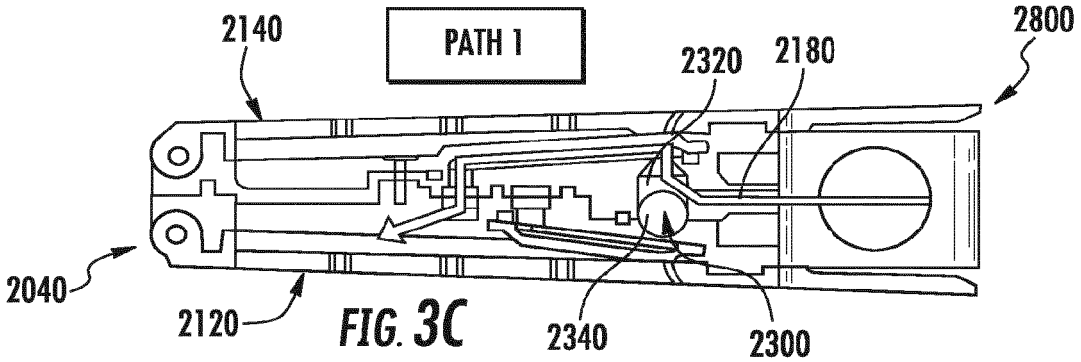

FIG. 3C

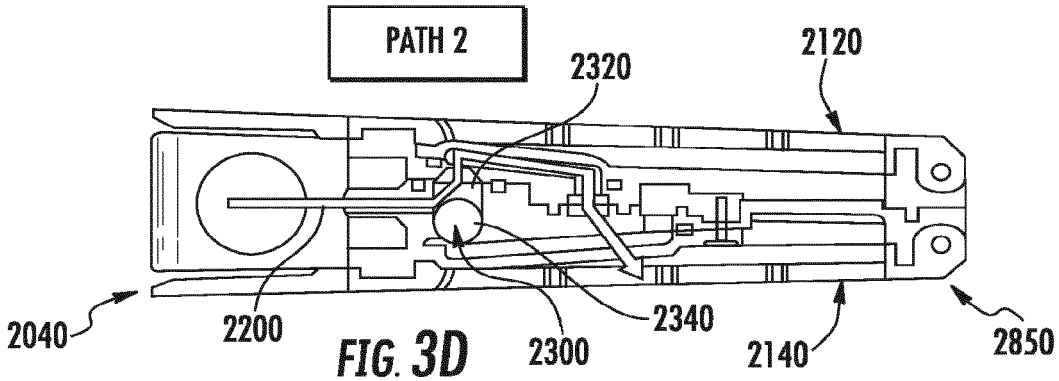

FIG. 3D

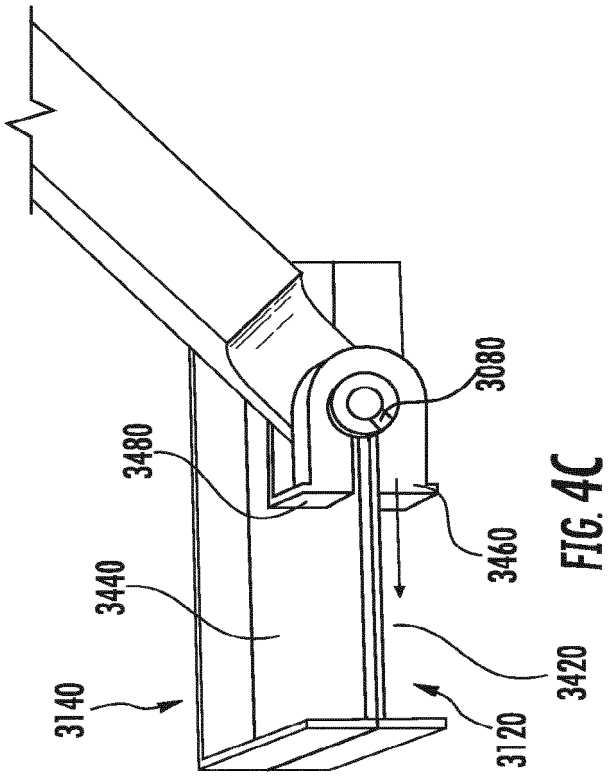

FIG. 4C

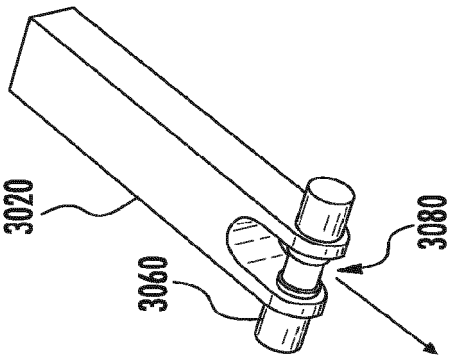

FIG. 4B

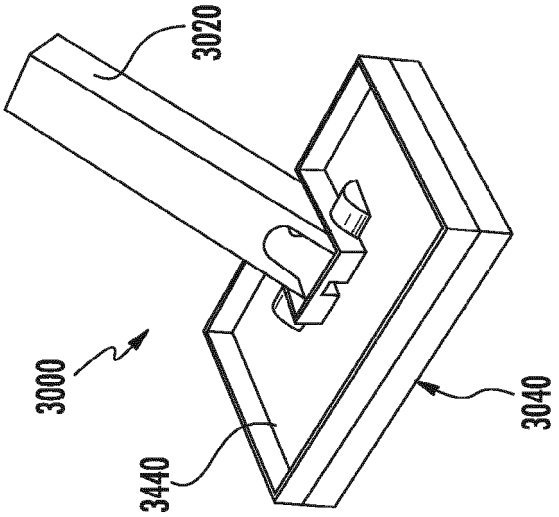

FIG. 4A

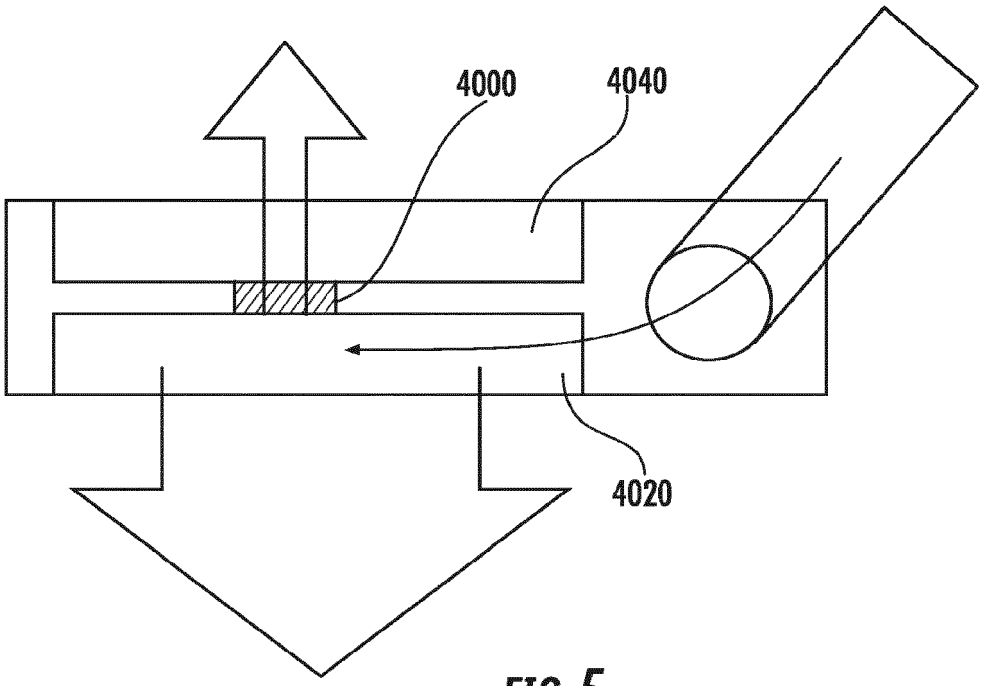

FIG. 5

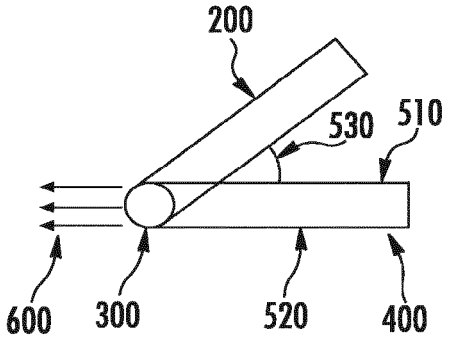

FIG. 6A

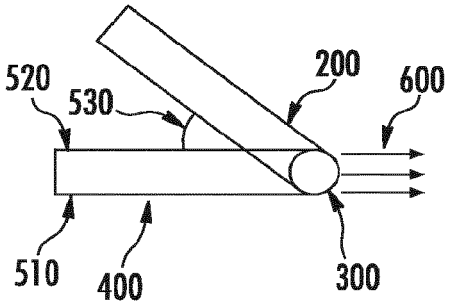

FIG. 6B

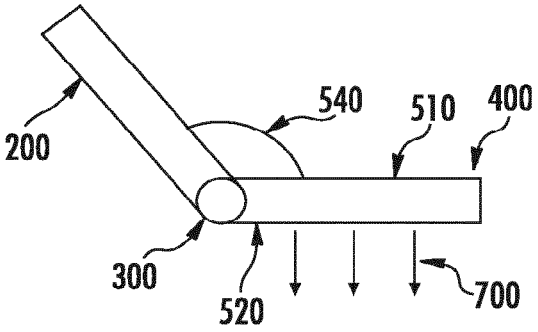

FIG. 6C

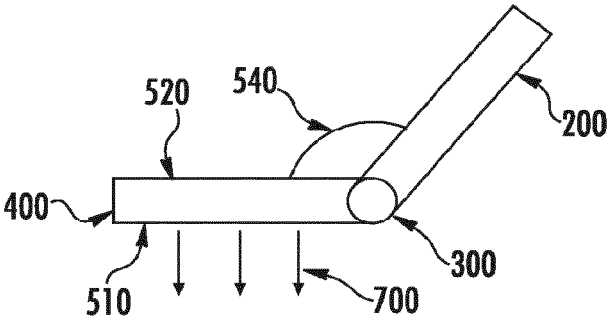

FIG. 6D

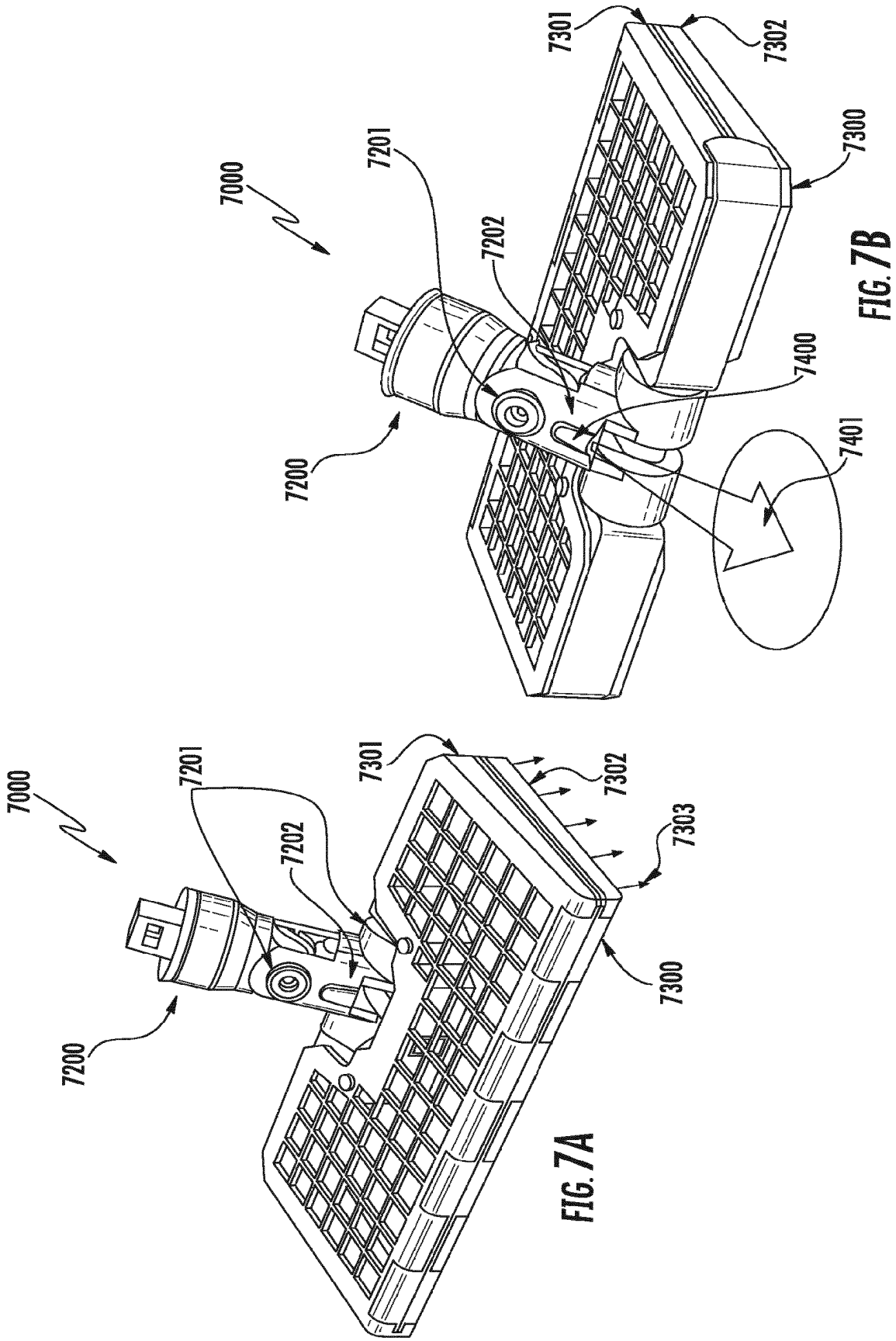
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FIG. 7A

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FIG. 7B

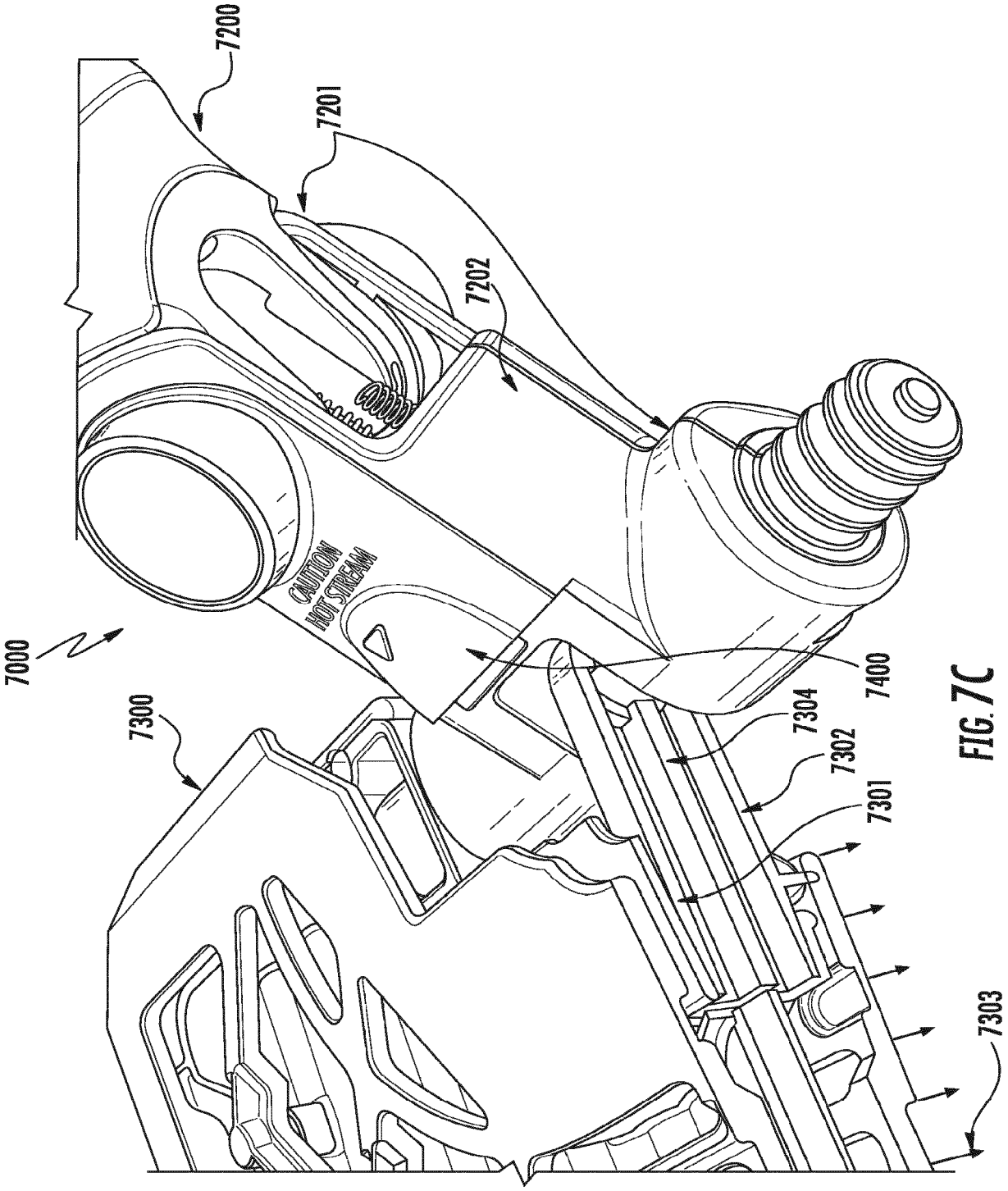
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FIG. 7C

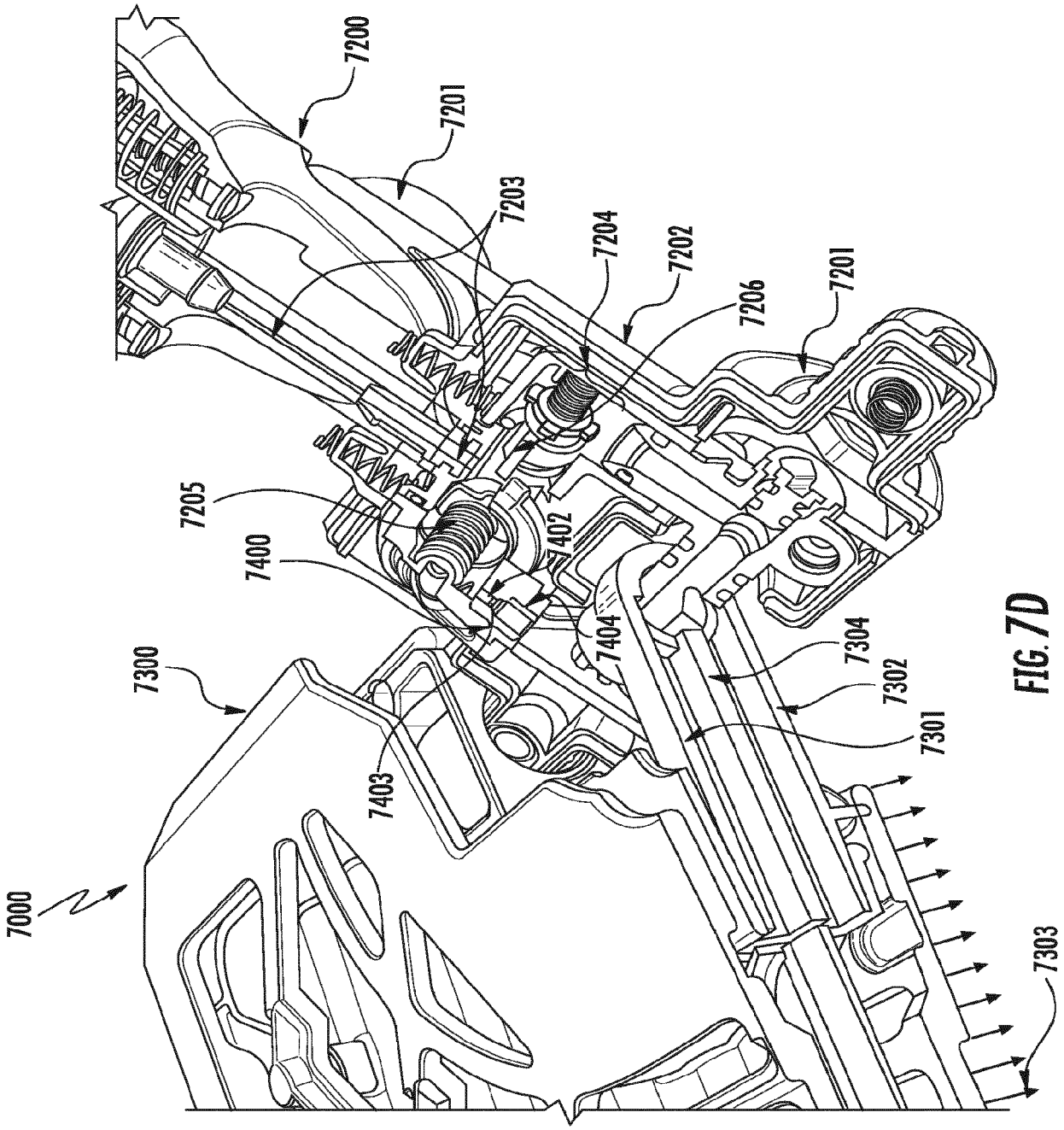
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FIG. 7D

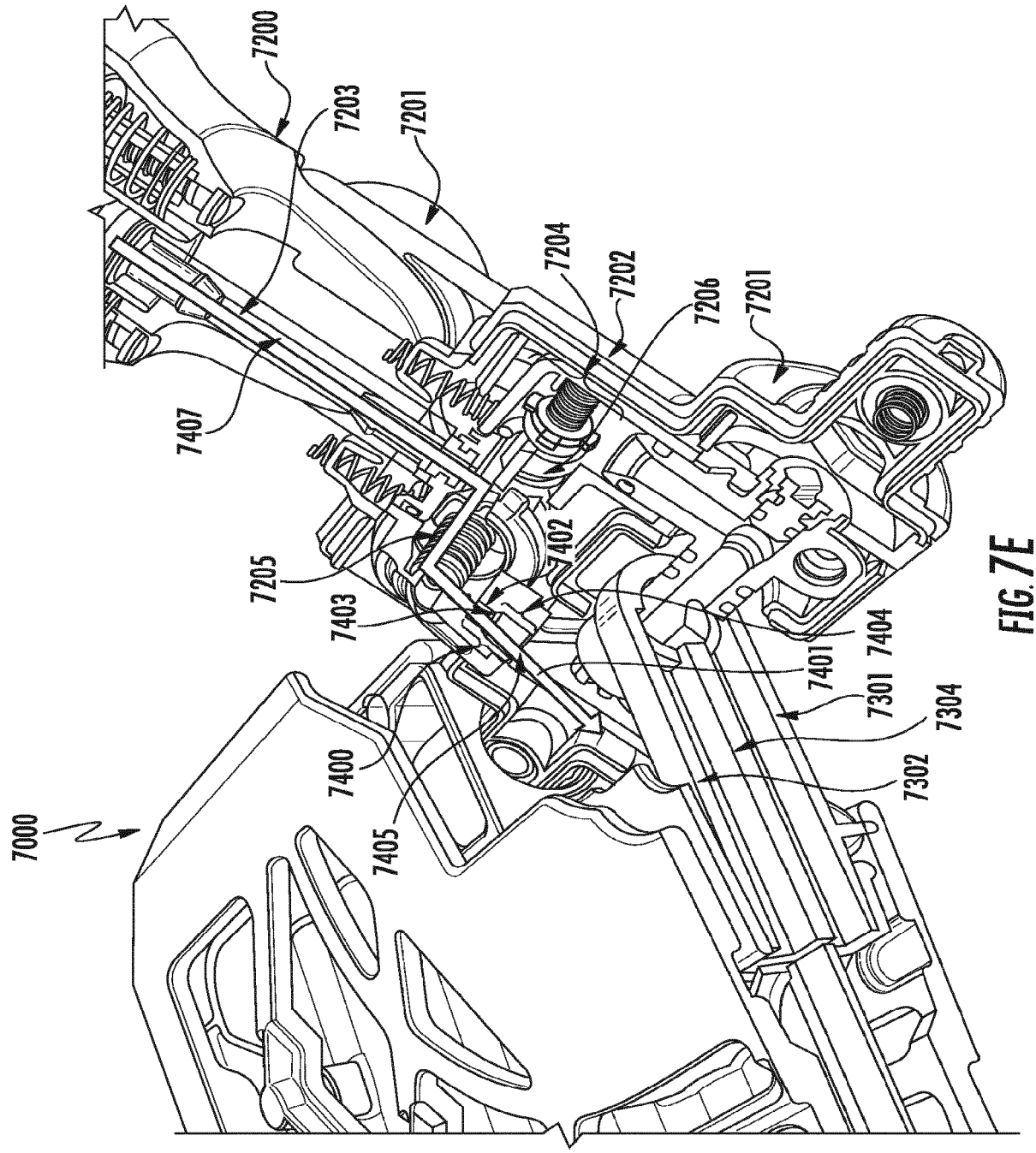
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FIG. 7E

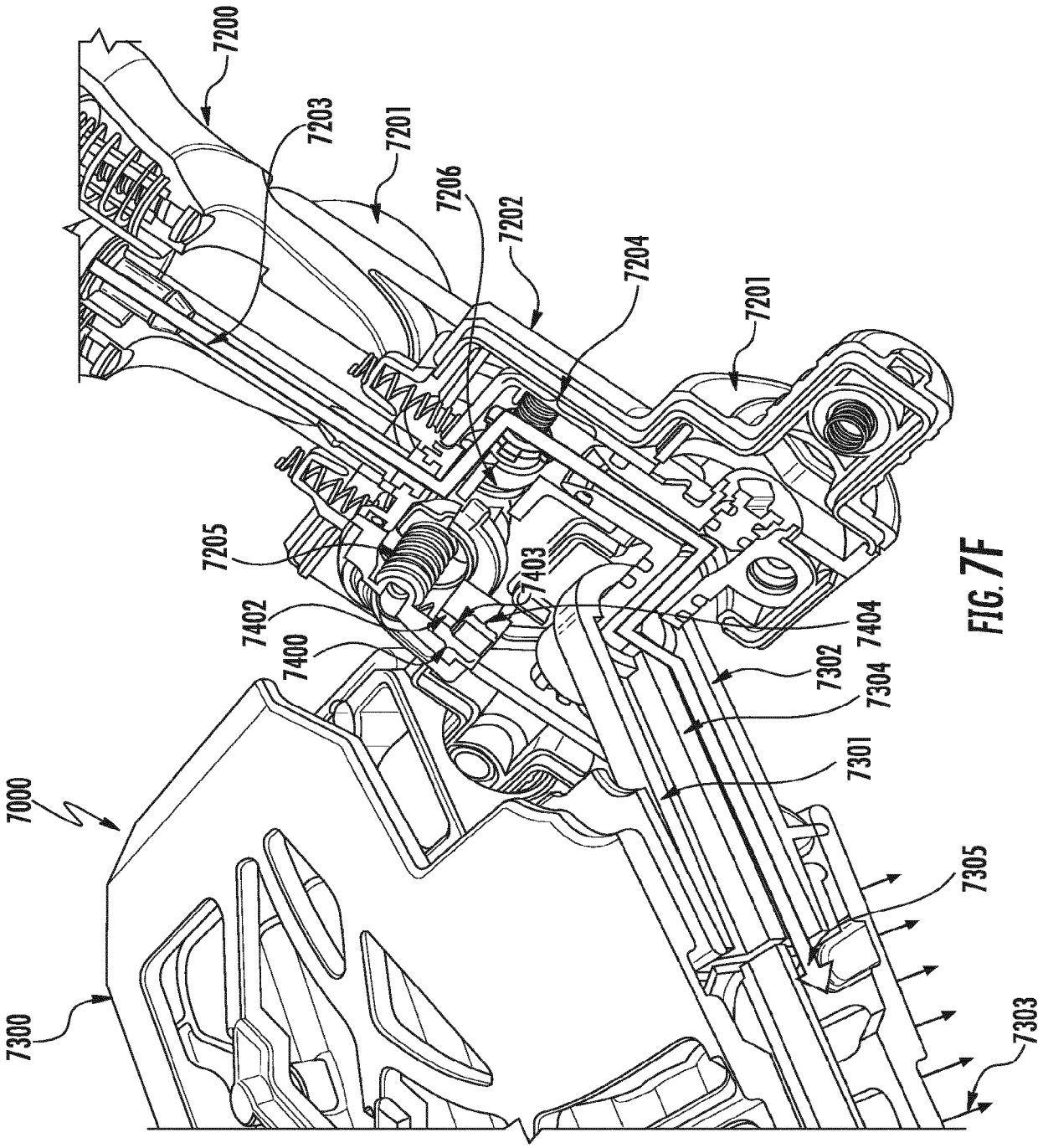
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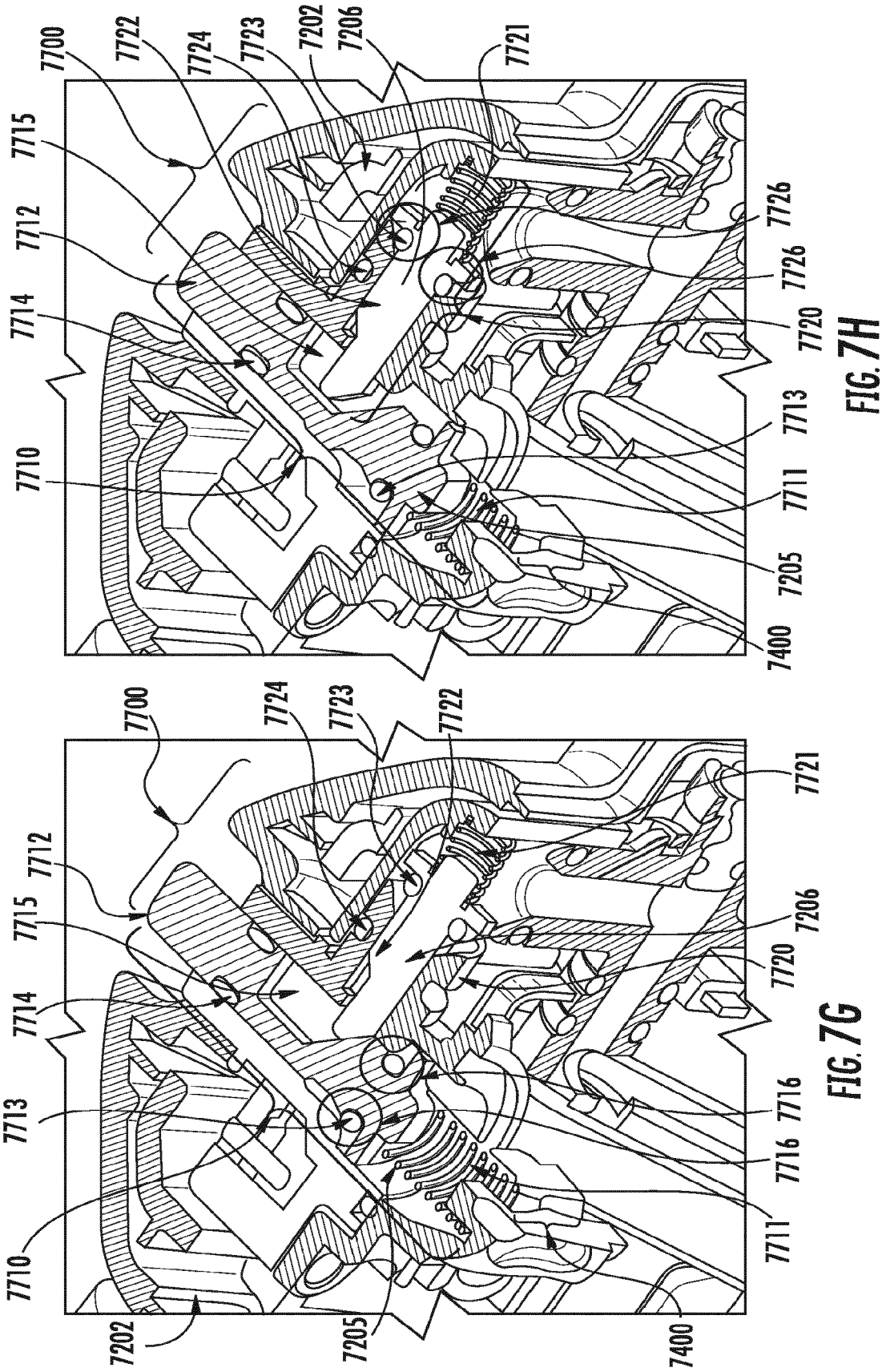
FIG. 7F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7202
7205
7400

FIG. 7H

FIG. 7G

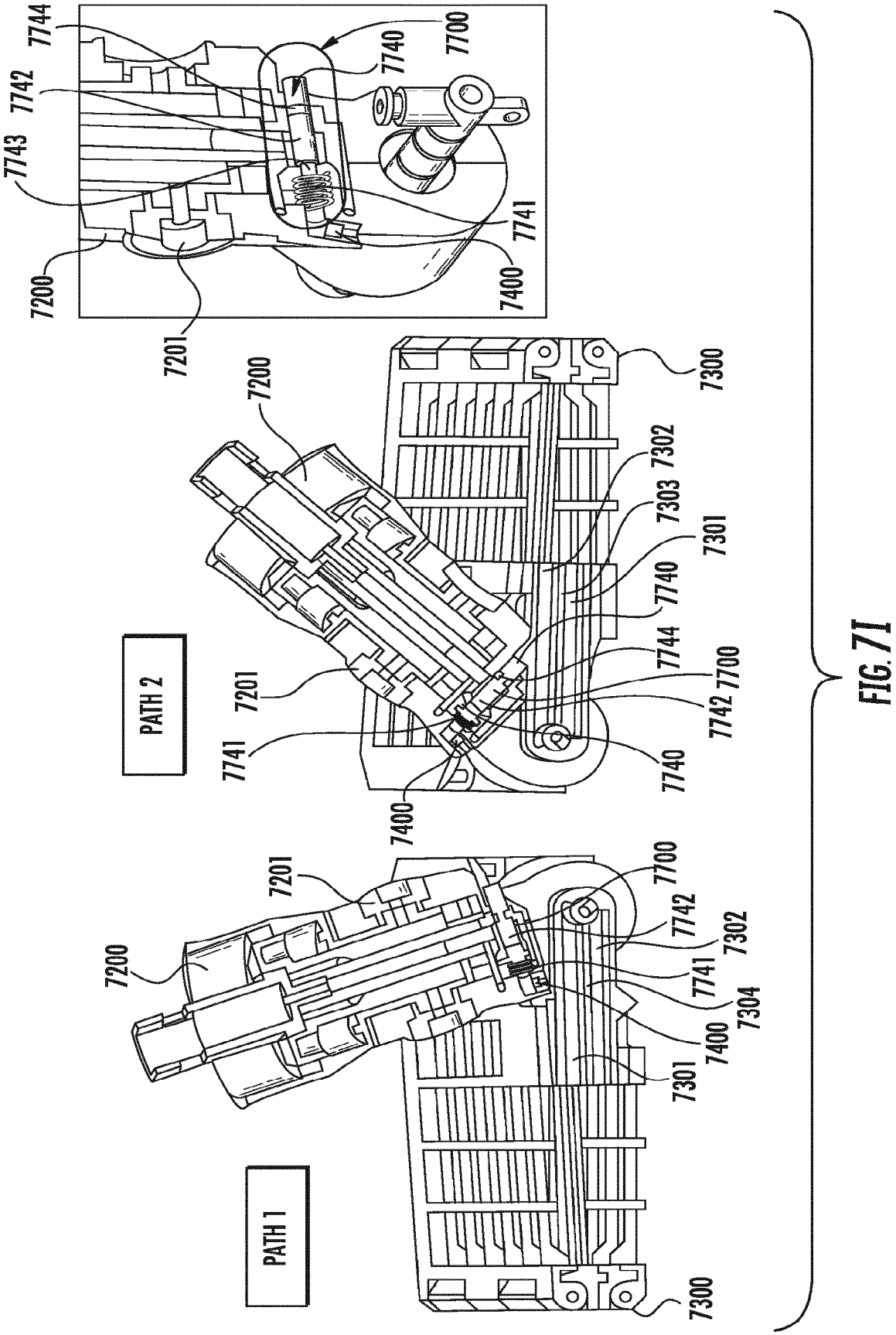
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FIG. 7I

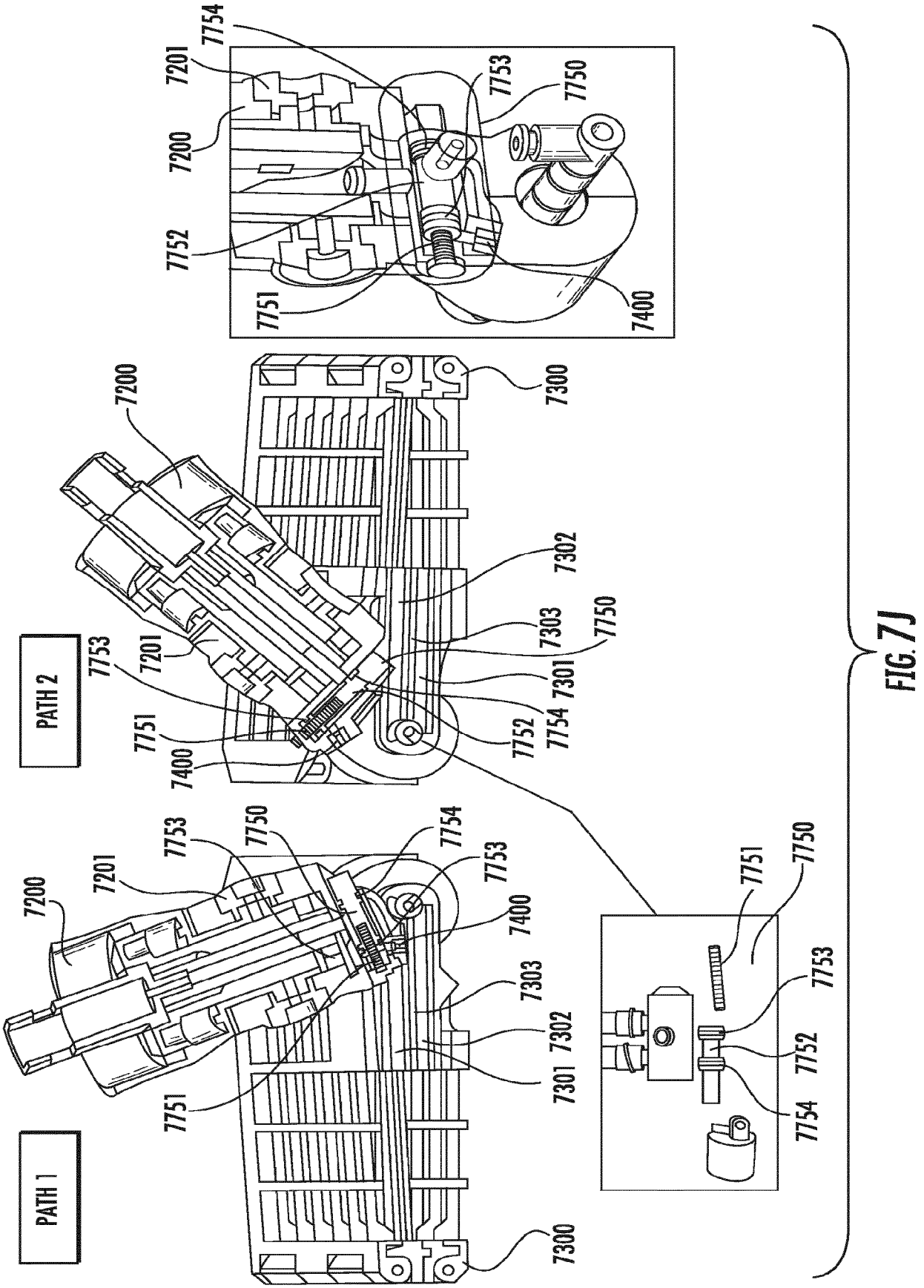
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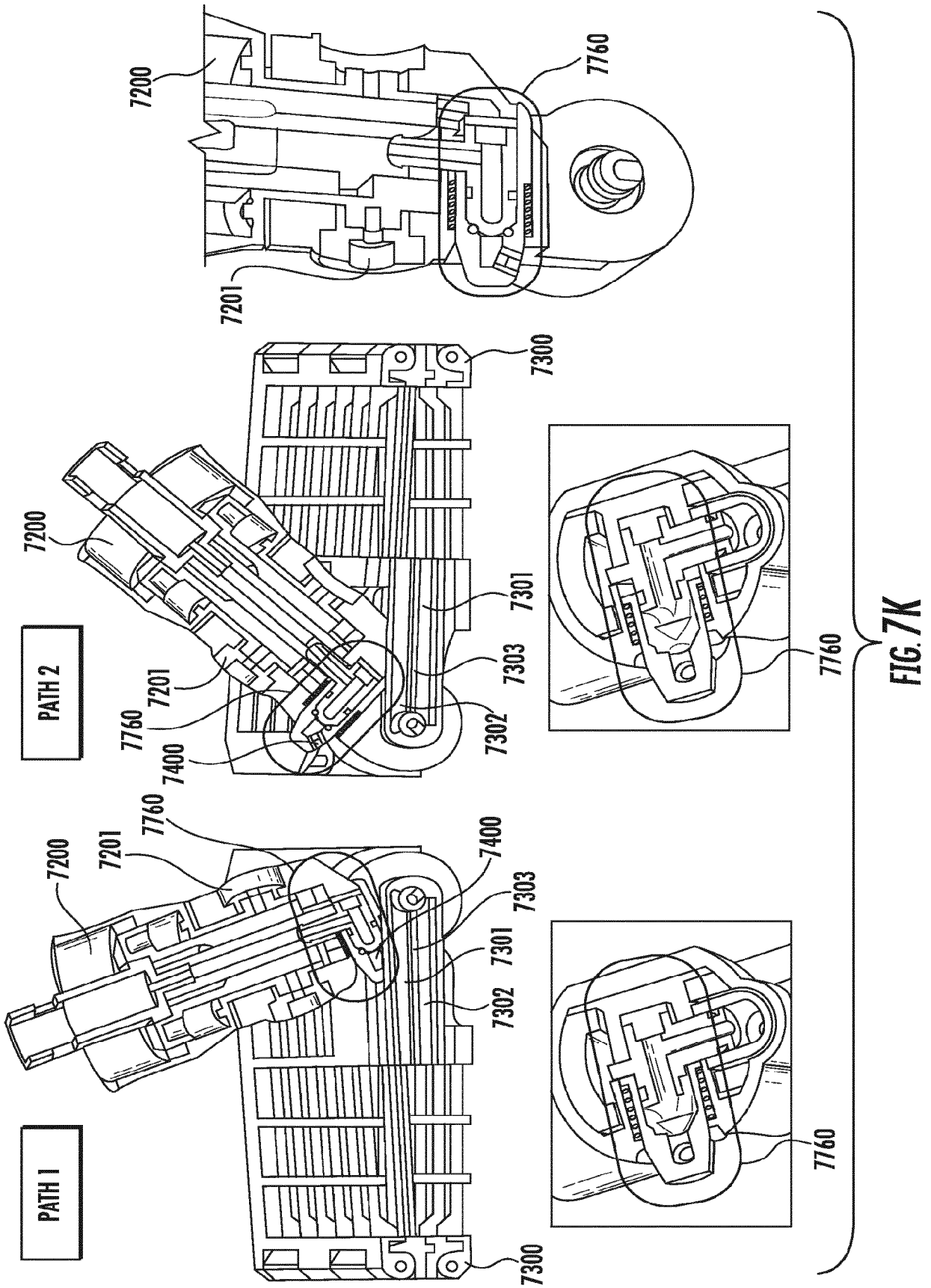
FIG. 7J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7302
7300
PATH 1
7760

FIG. 7K

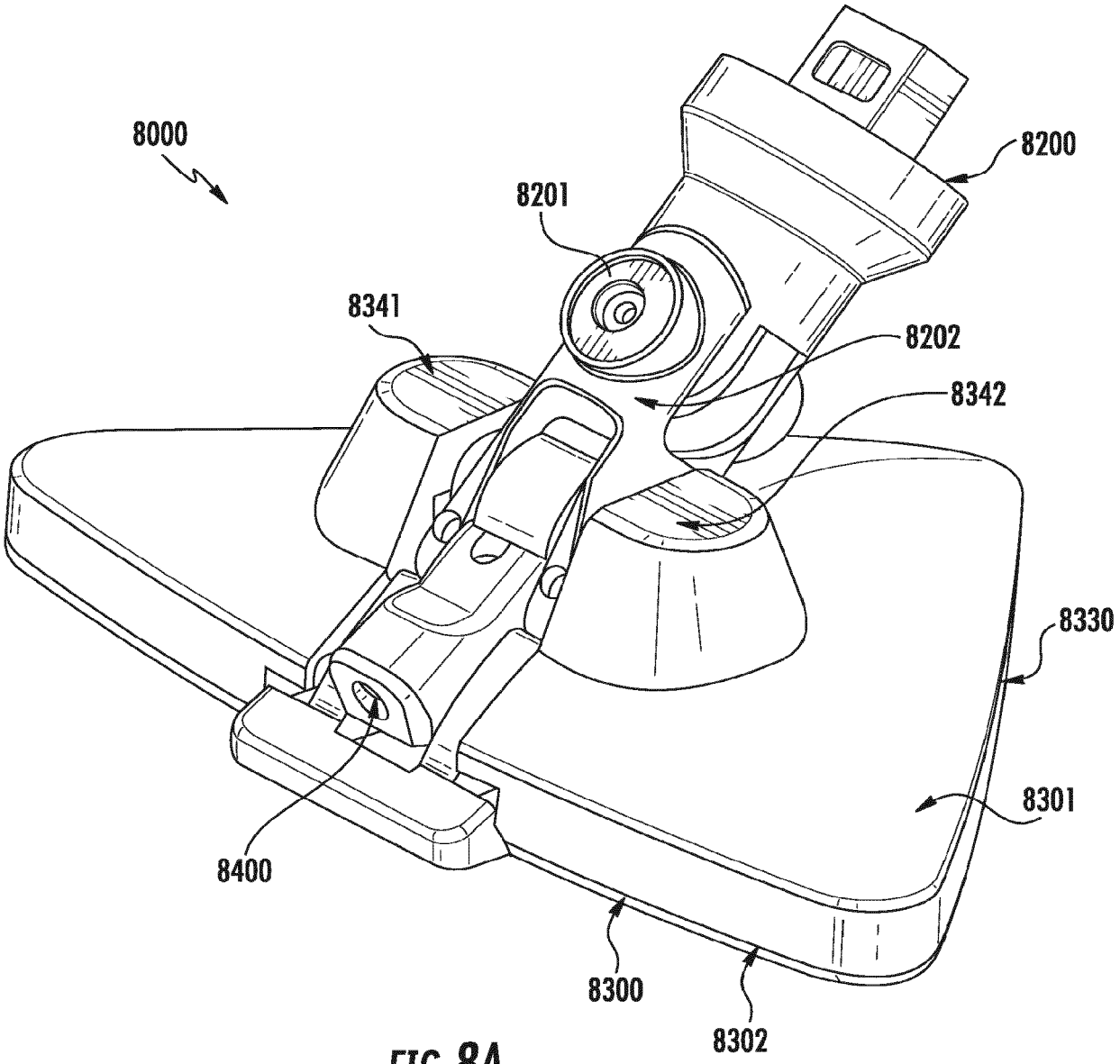
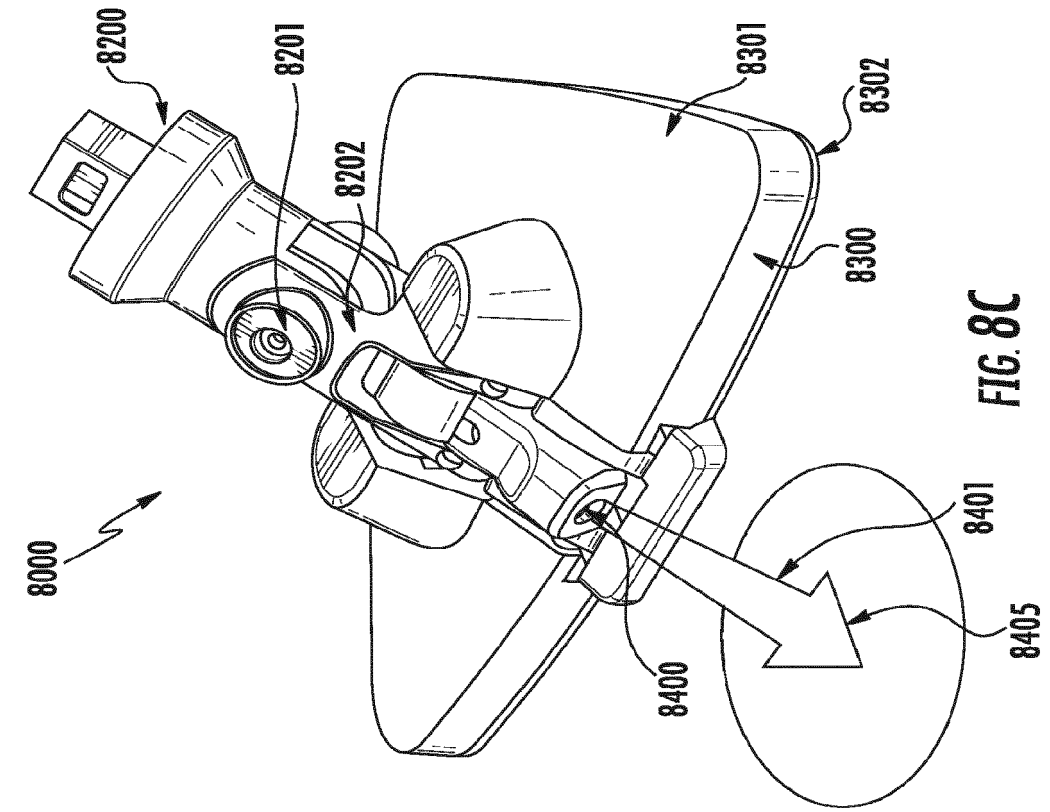


FIG. 8A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8400

FIG. 8C

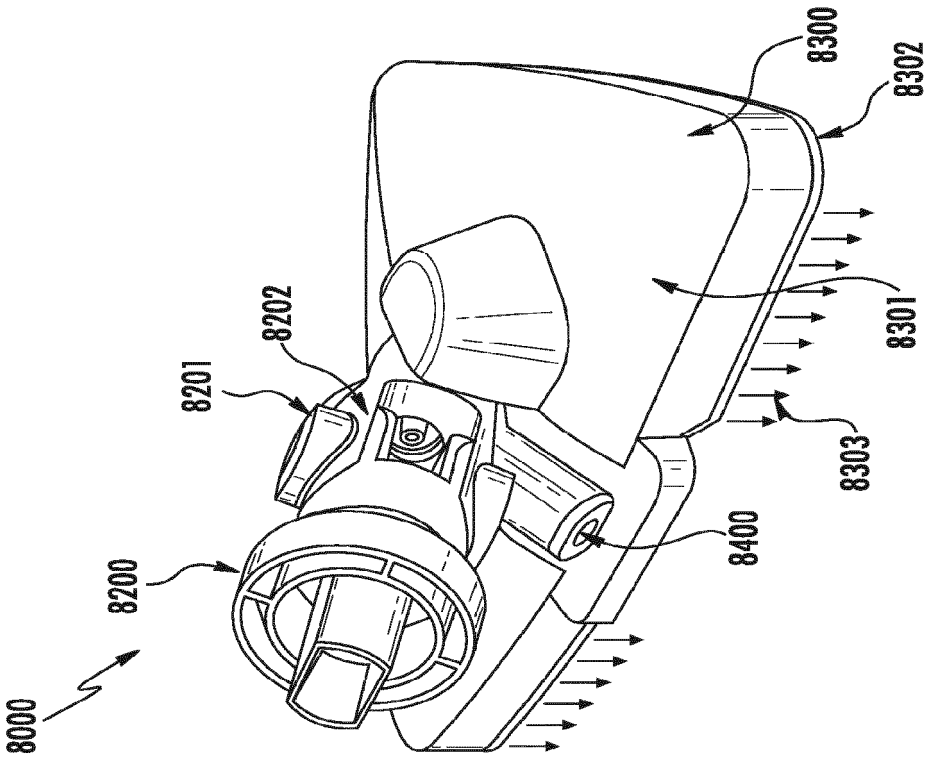
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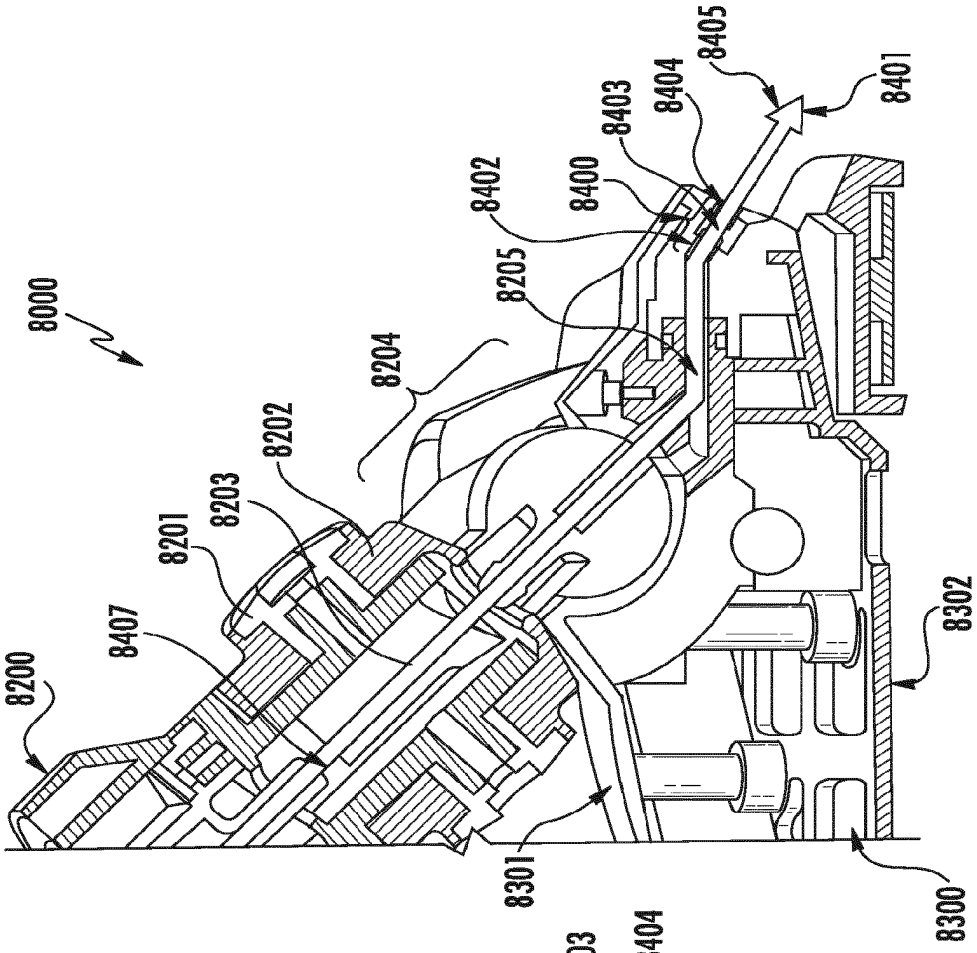
FIG. 8B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8301
8300

FIG. 8E

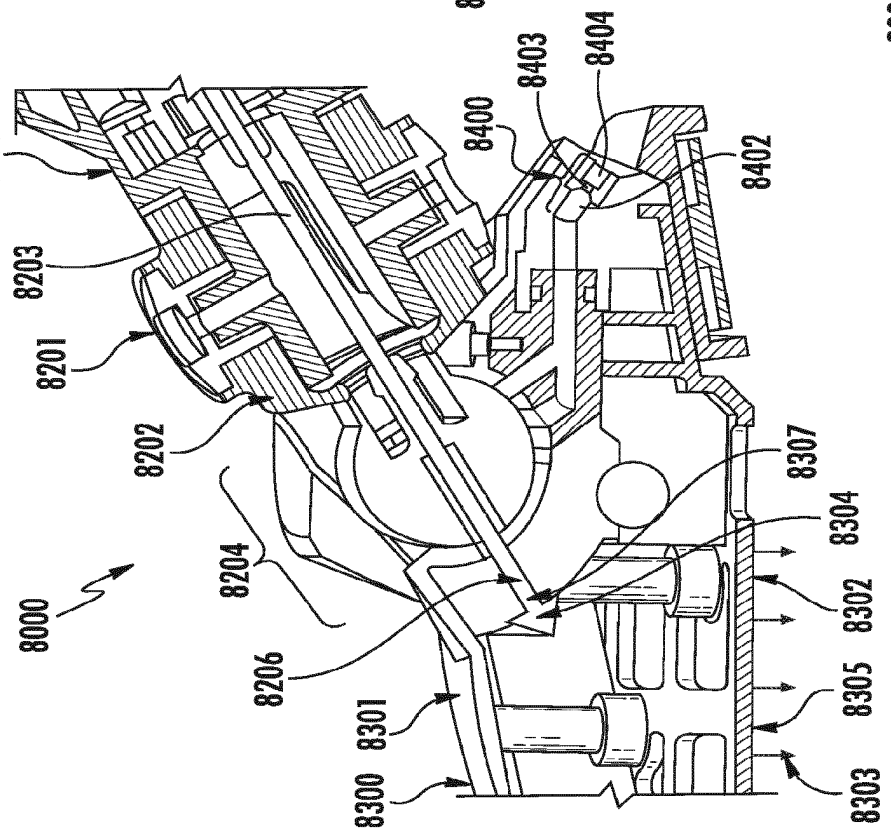
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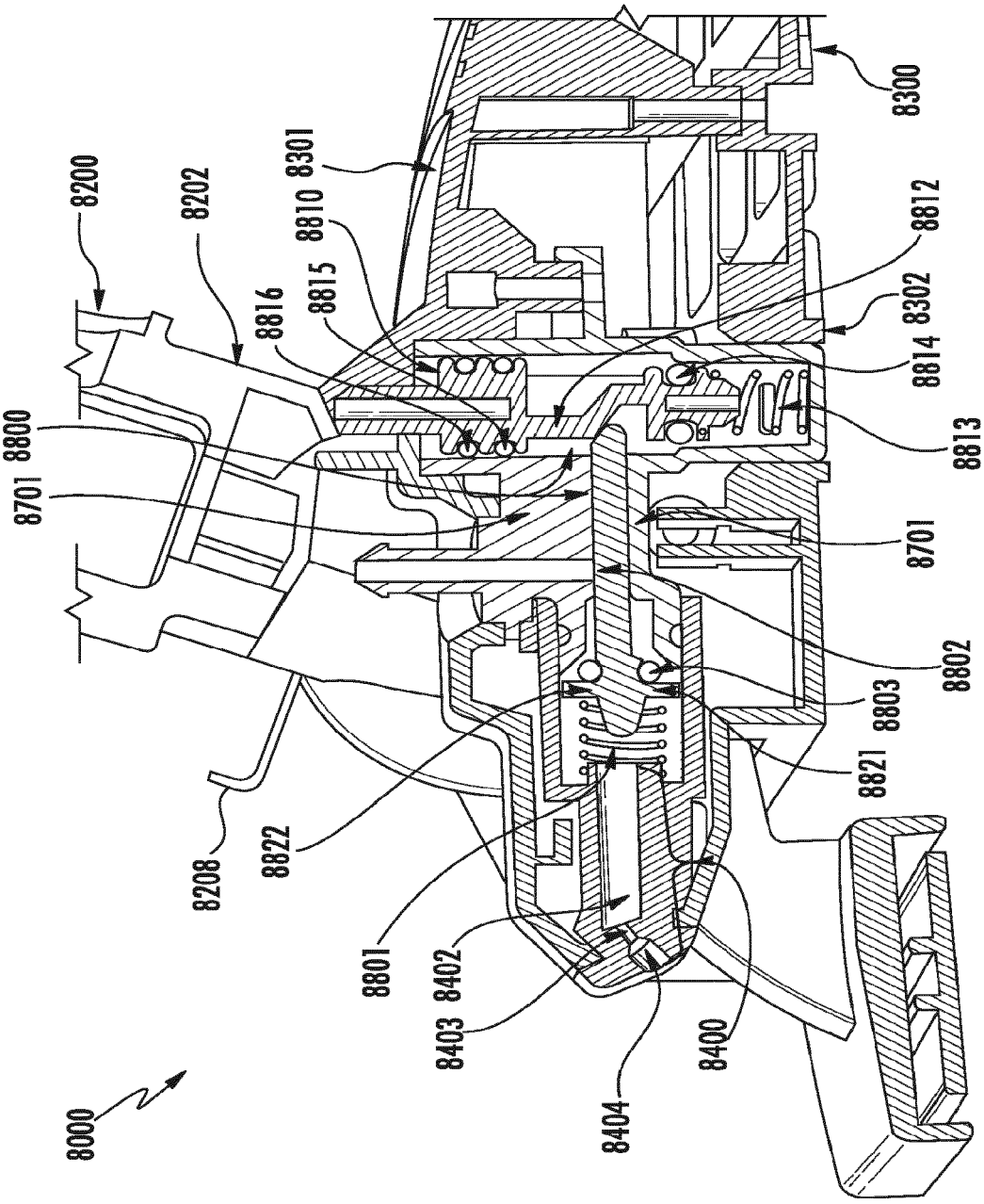
FIG. 8D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8801
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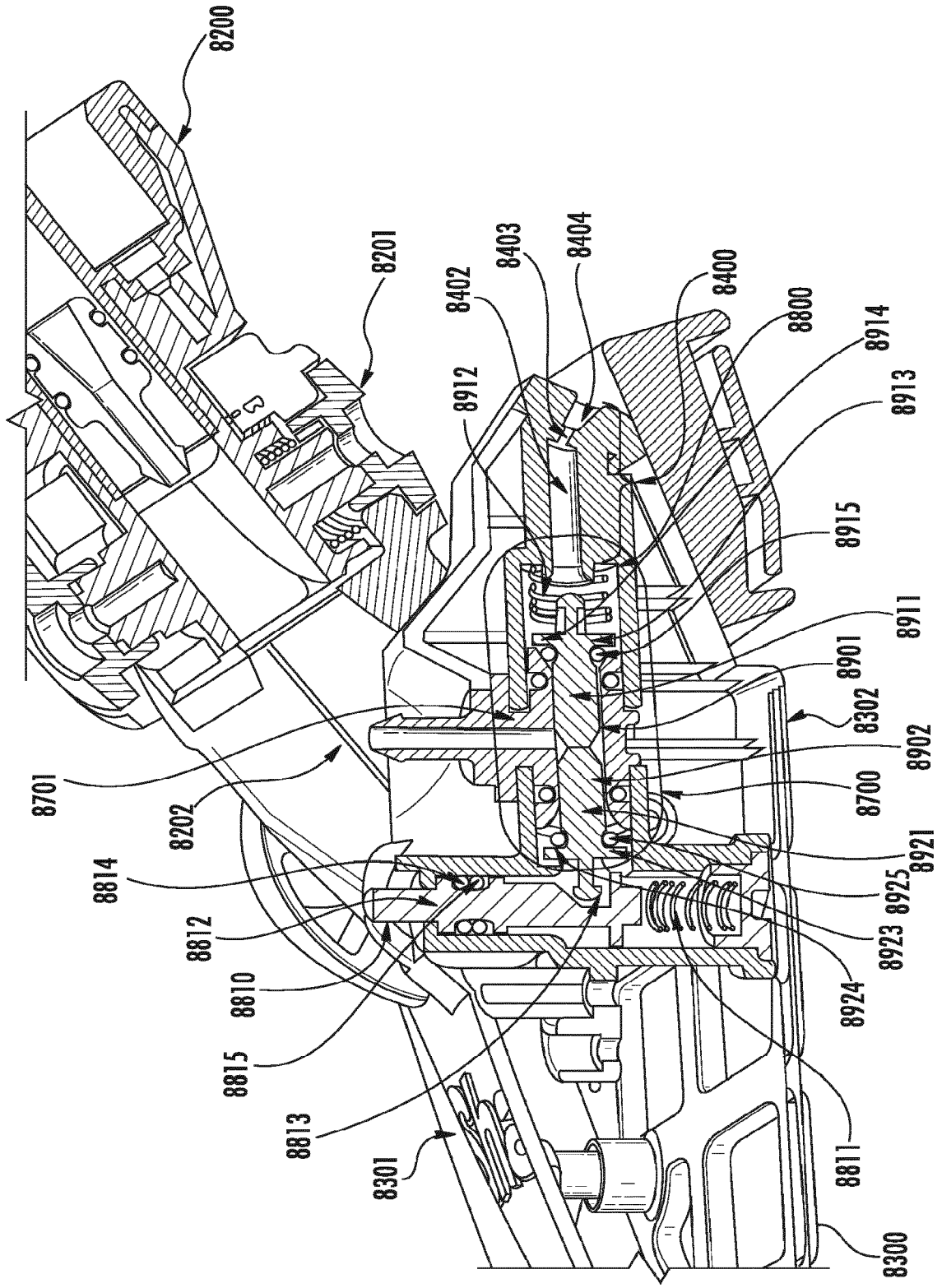
8404
8400

FIG. 8F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8301
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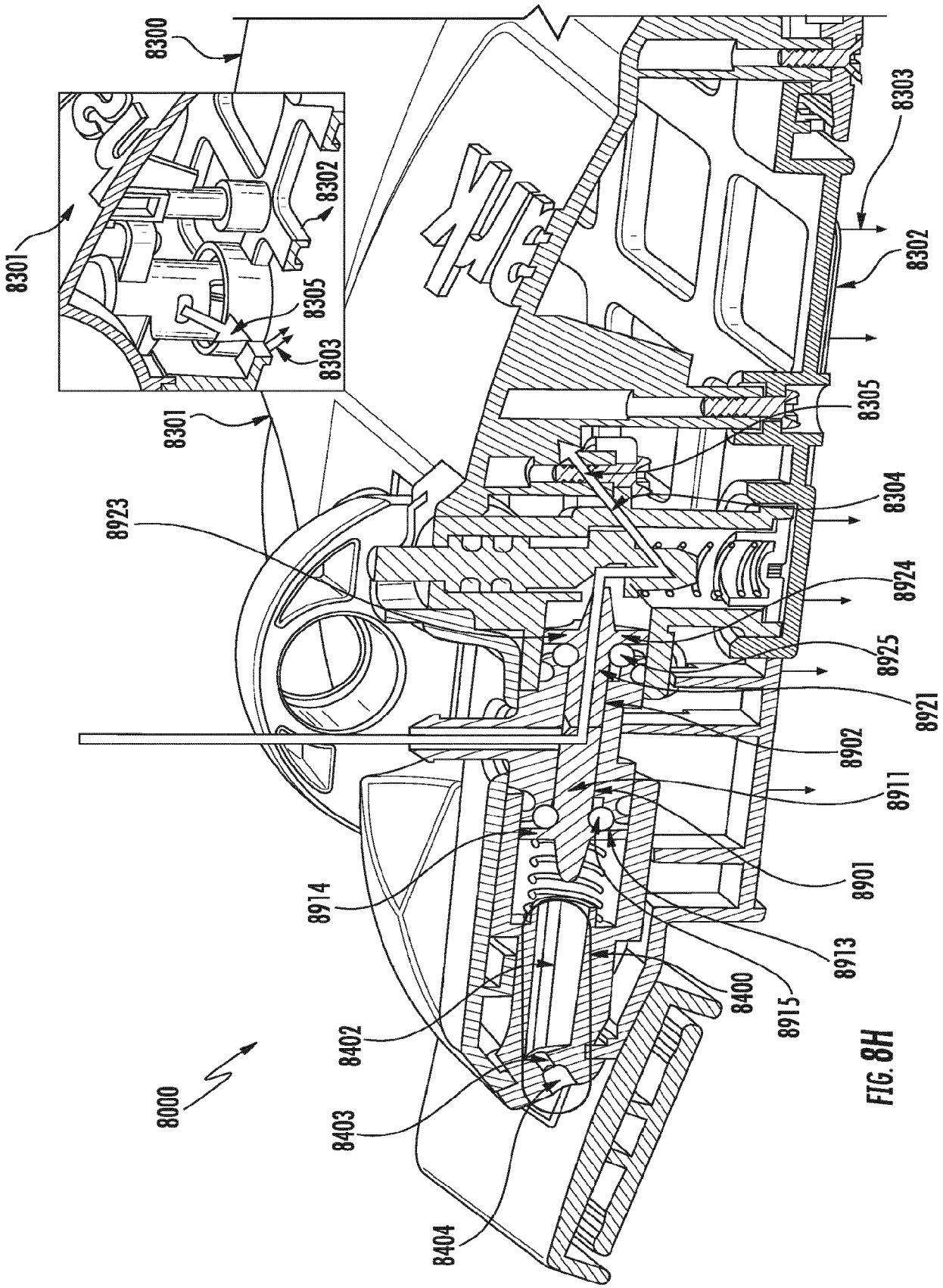
8815
8810
8812
8814
8202
8701

FIG. 8G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8914
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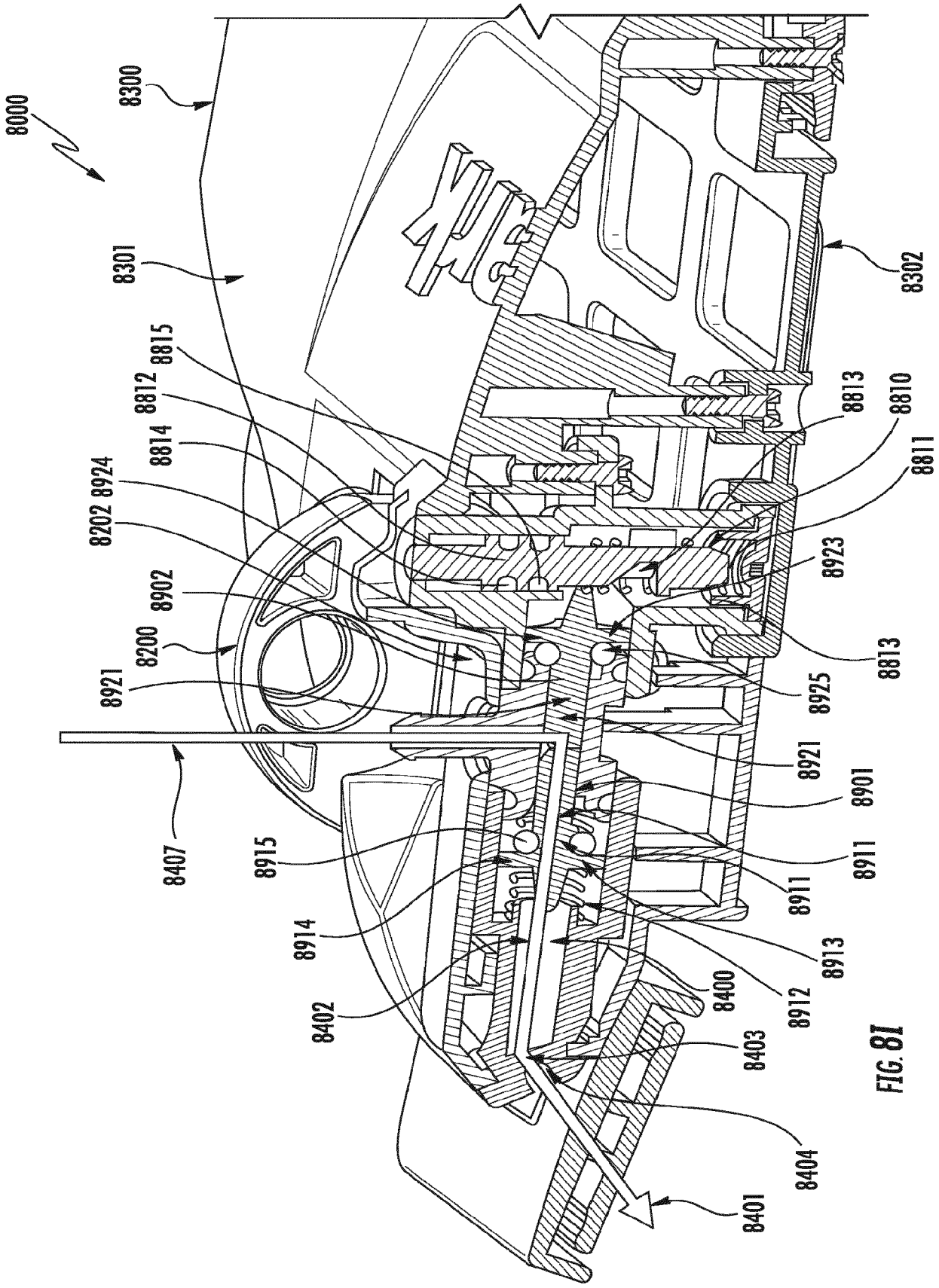
8915
8402
8403
8404
8000

FIG. 8H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8407
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8403
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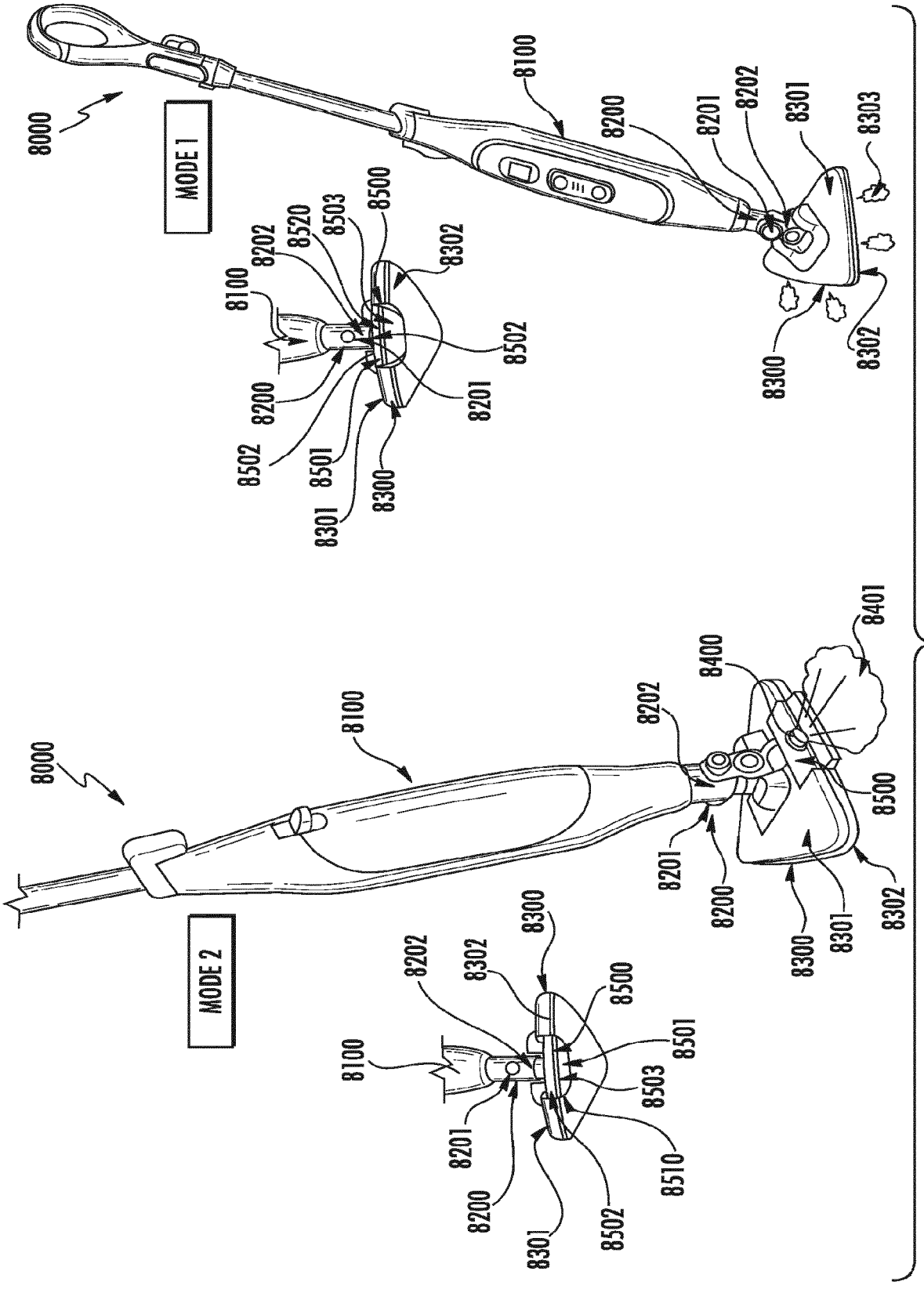
8923
8810
8813
8811

FIG. 81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MODE 2
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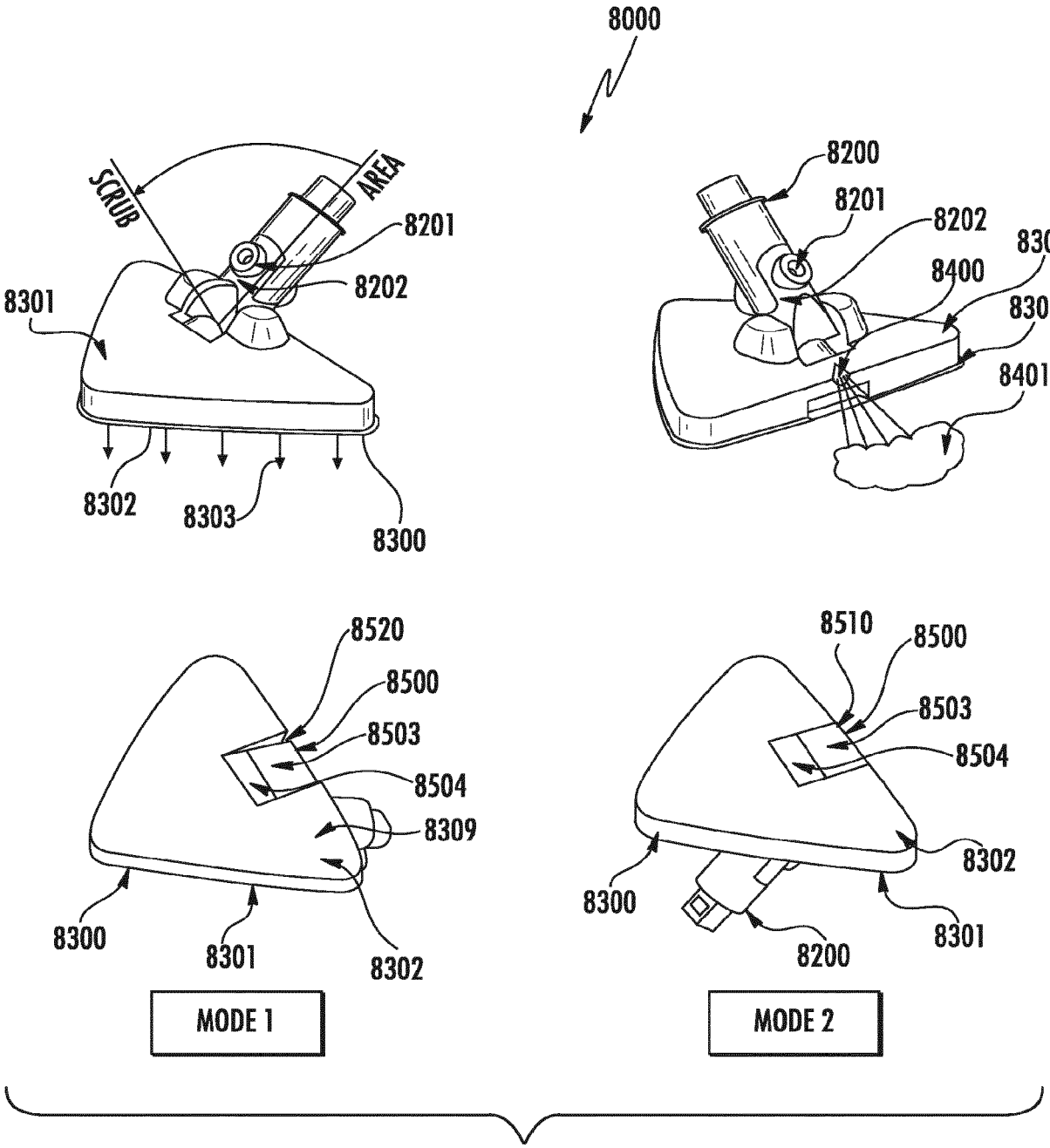
8510

FIG. 8J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8301
8400
8302
8401
8520
8500
8503
8504
8309
8300
8301
8302
MODE 1
8510
8500
8503
8504
8302
8300
8200
8301
MODE 2

FIG. 8K

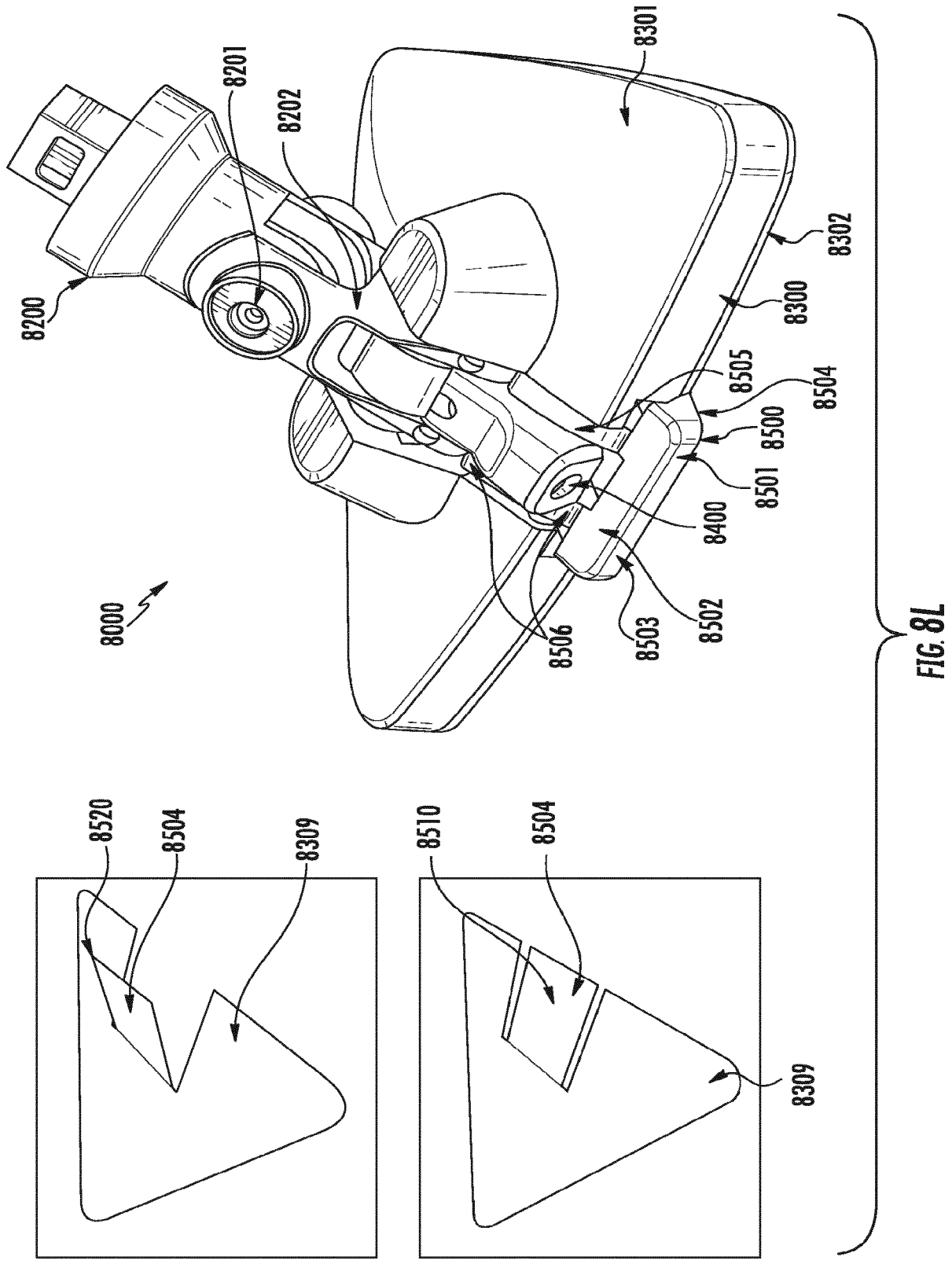

8000
8200
8201
8202
8301
8302
8300
8505
8504
8500
8501
8400
8502
8503
8506
8520
8504
8309
8510
8504
8309

FIG. 8L

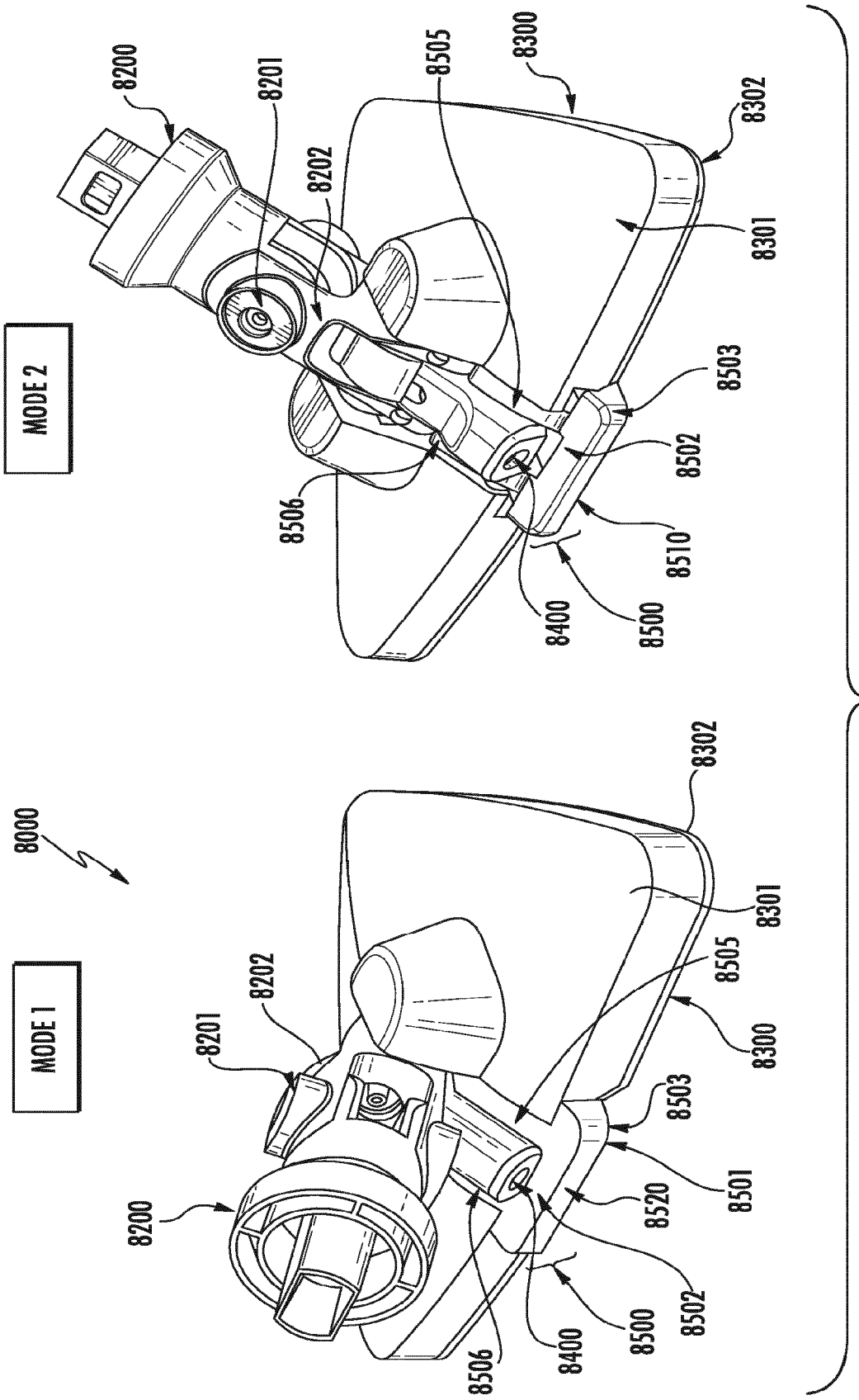

MODE 1
8000
8200
8201
8202
8506
8400
8500
8502
8520
8501
8503
8505
8300
8301
8302
MODE 2
8200
8201
8202
8505
8300
8302
8301
8503
8502
8510
8500
8400
8506

FIG. 8M

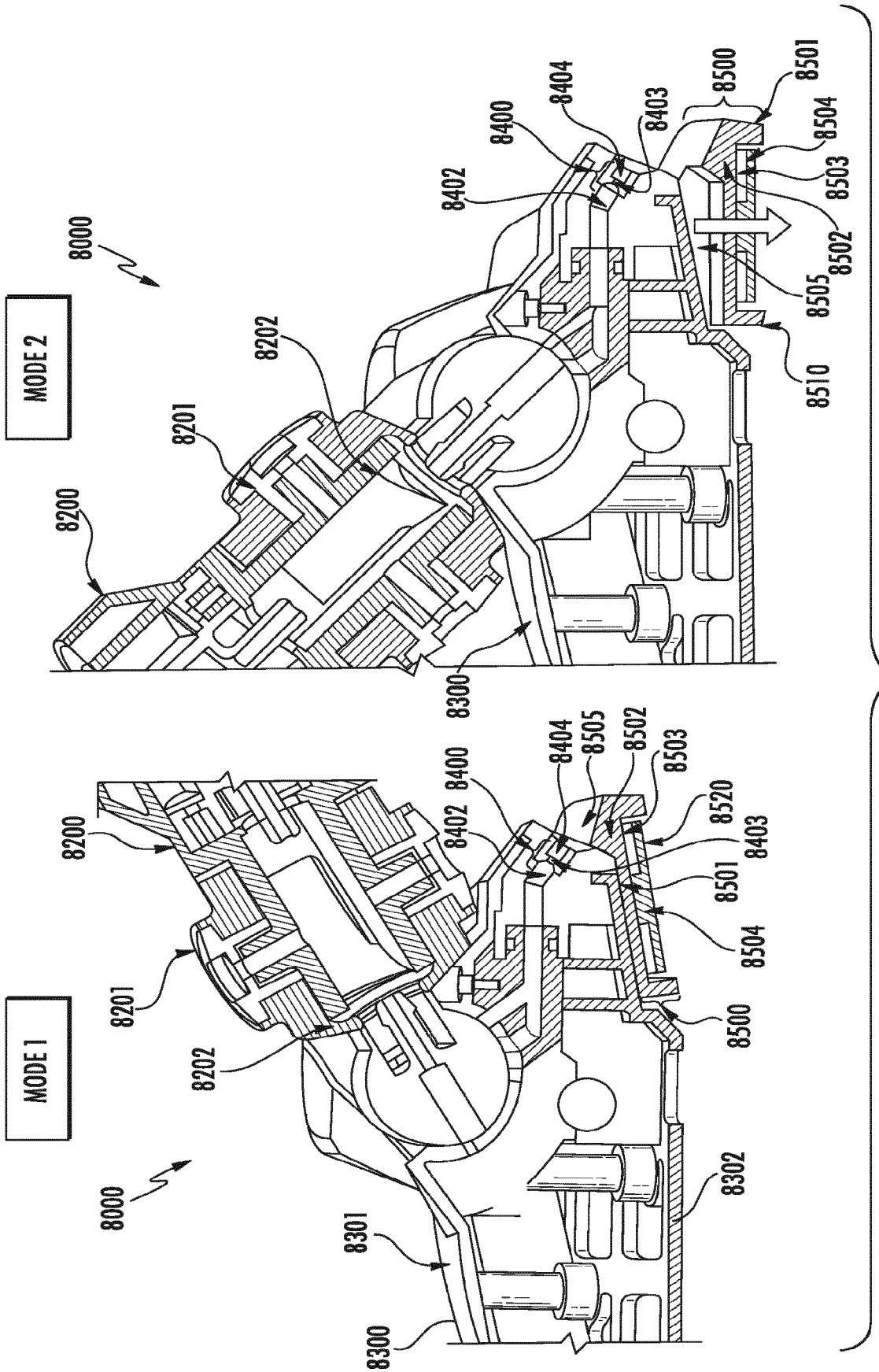

MODE 1
8000
8200
8201
8202
8301
8300
8400
8402
8404
8505
8502
8503
8520
8403
8501
8504
8500
8302
MODE 2
8000
8200
8201
8202
8400
8402
8404
8403
8500
8501
8504
8503
8502
8505
8510
8300

FIG. 8N

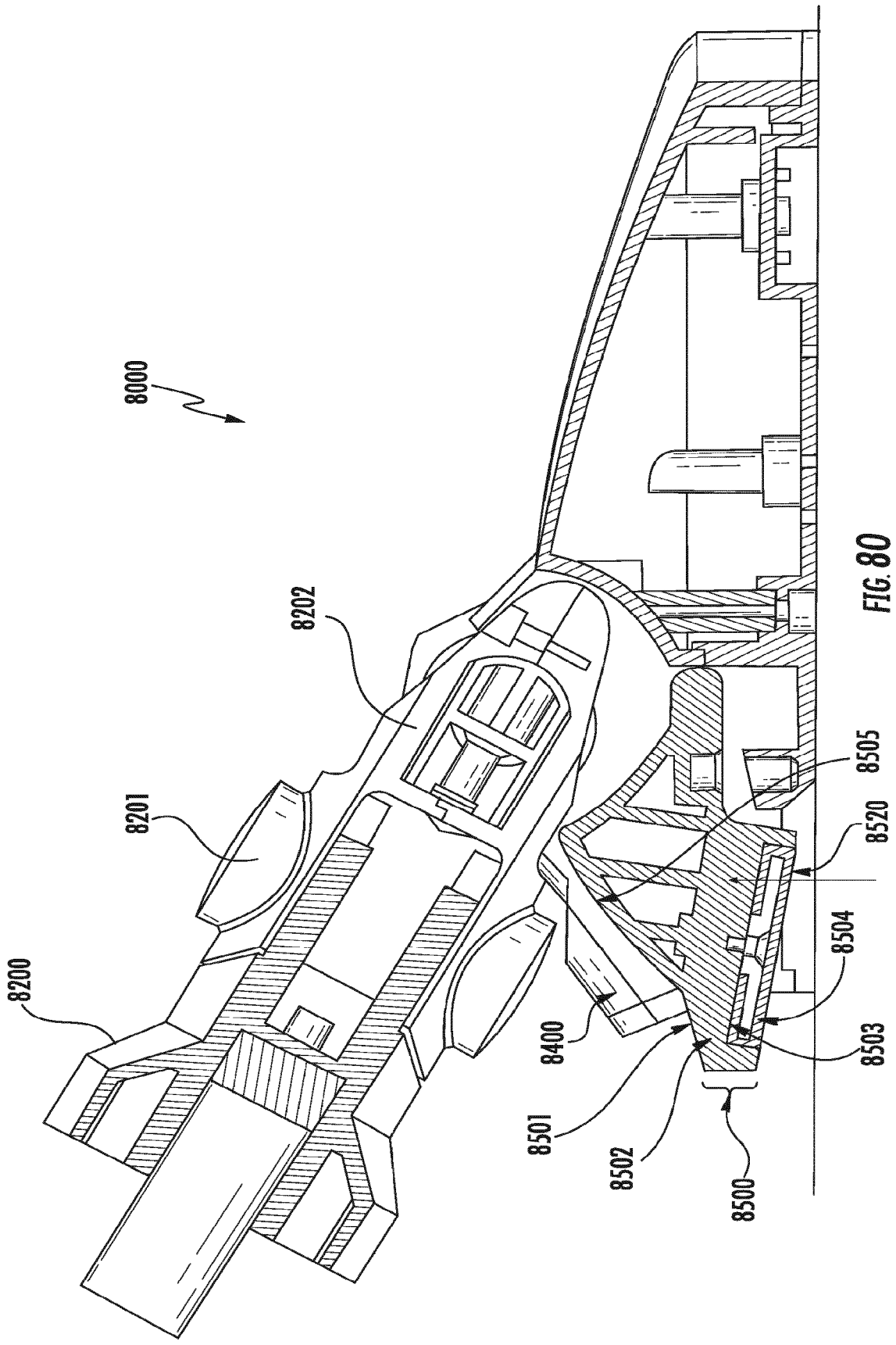
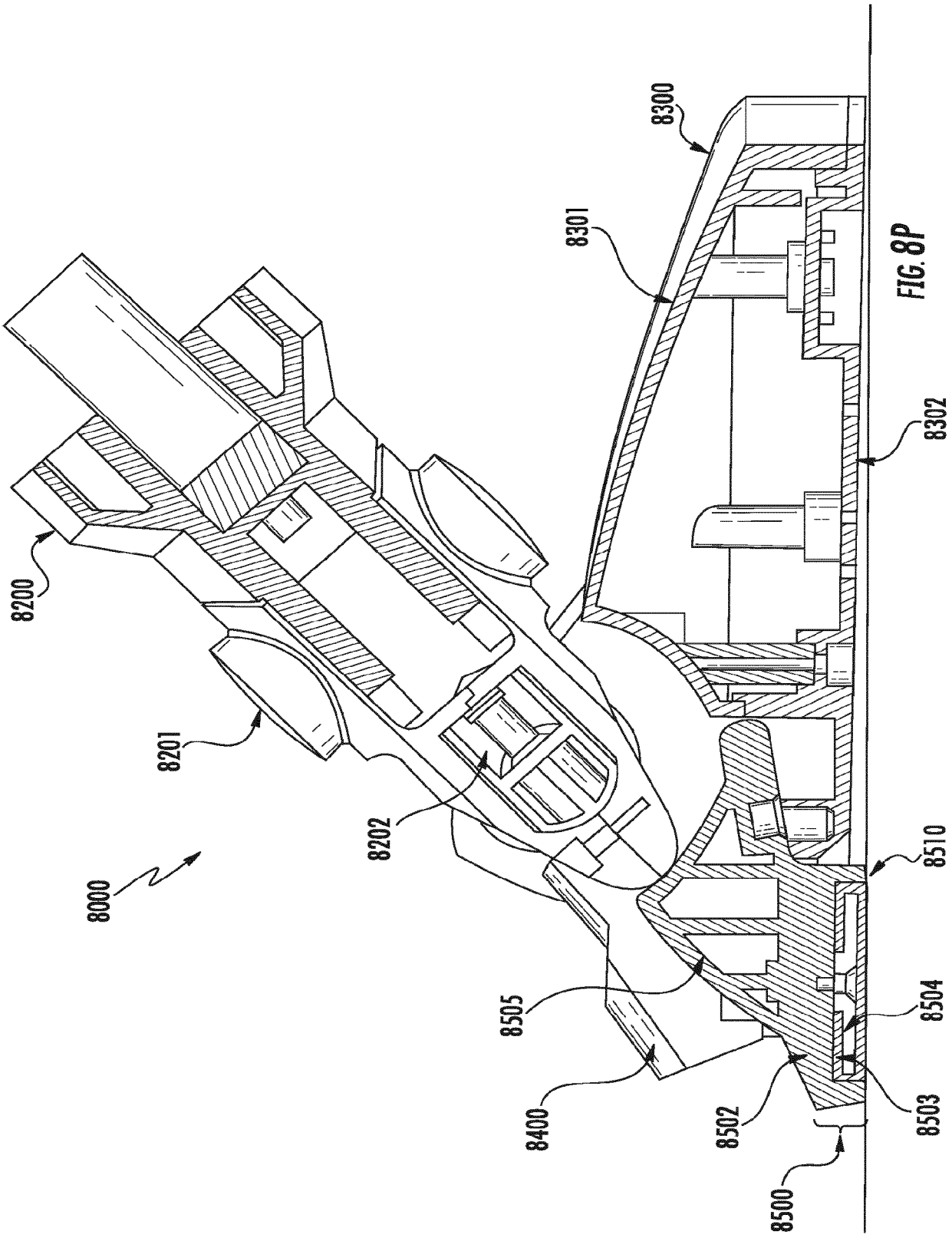


FIG. 80


8300
8301
8302
8200
8201
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8000
8510
8505
8504
8503
8400
8502
8500

FIG. 8P

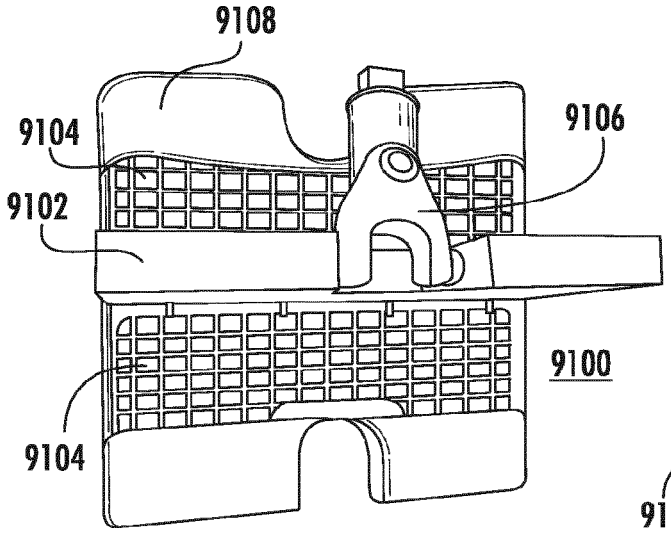


FIG. 9

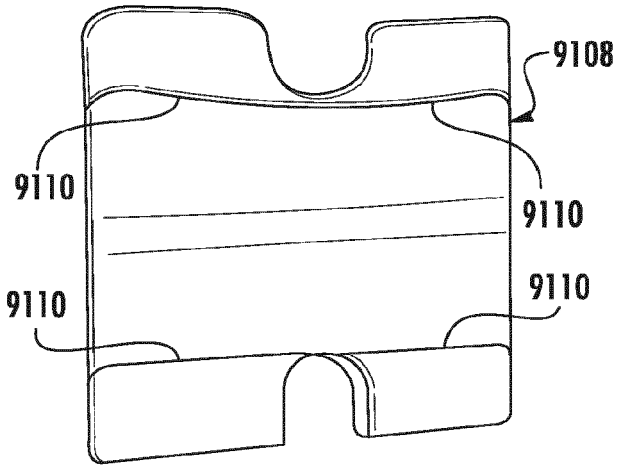


FIG. 10

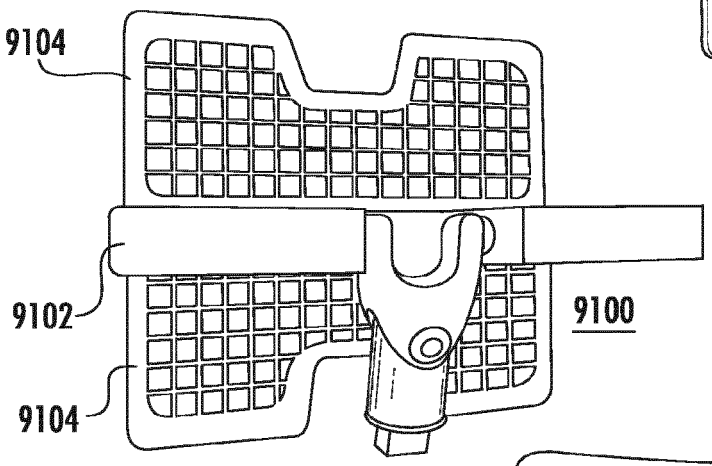


FIG. 11

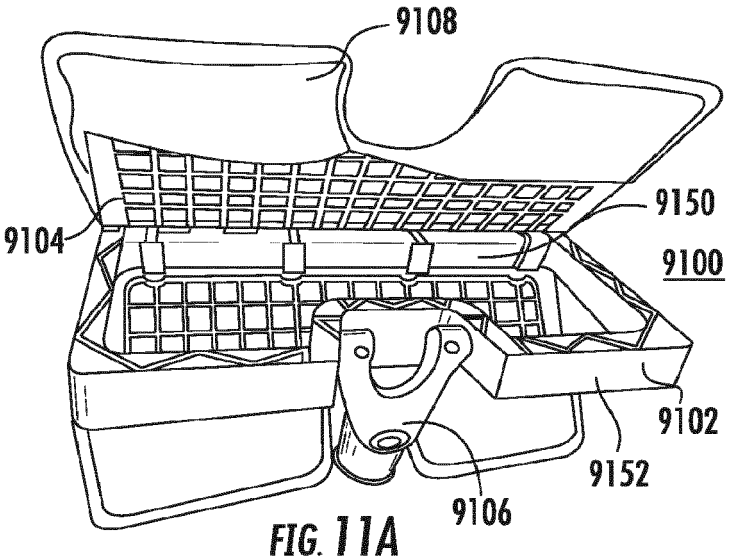


FIG. 11A

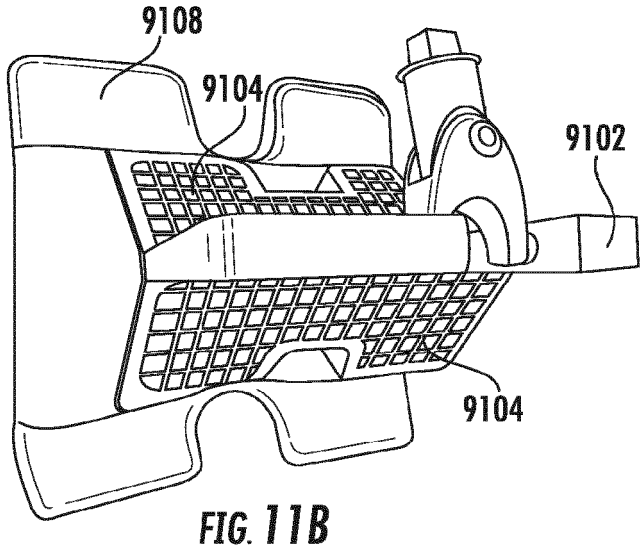


FIG. 11B

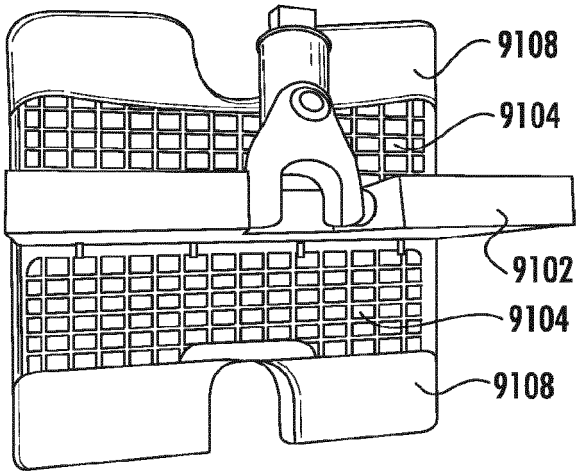


FIG. 11C

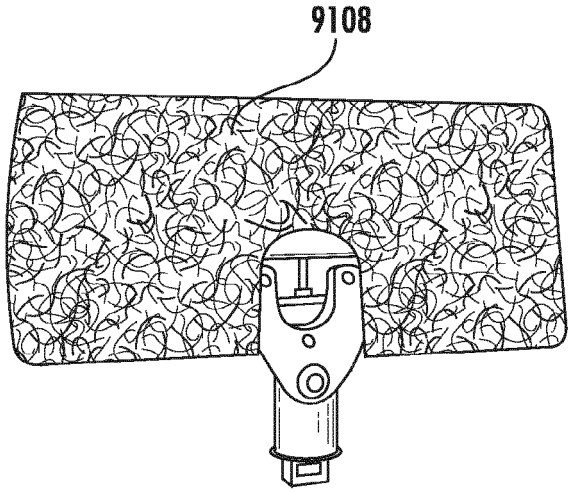


FIG. 11D

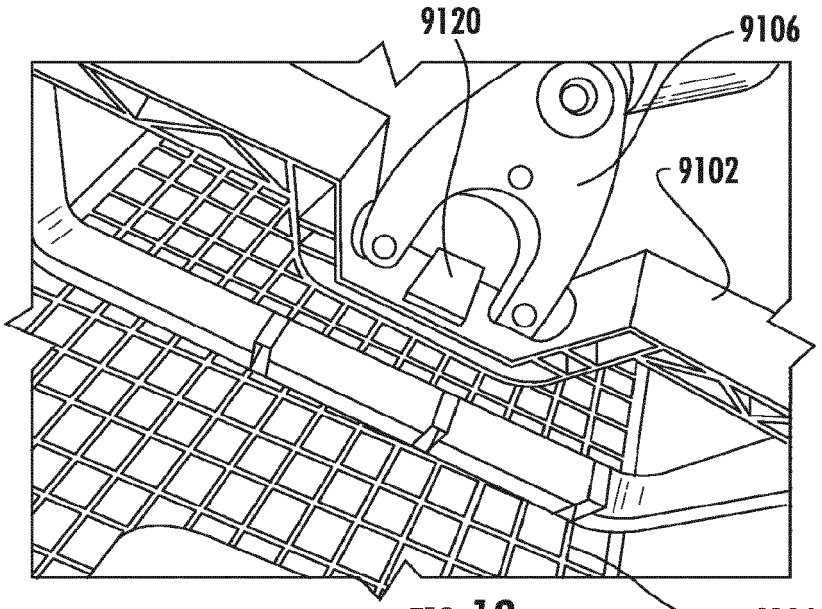


FIG. 12

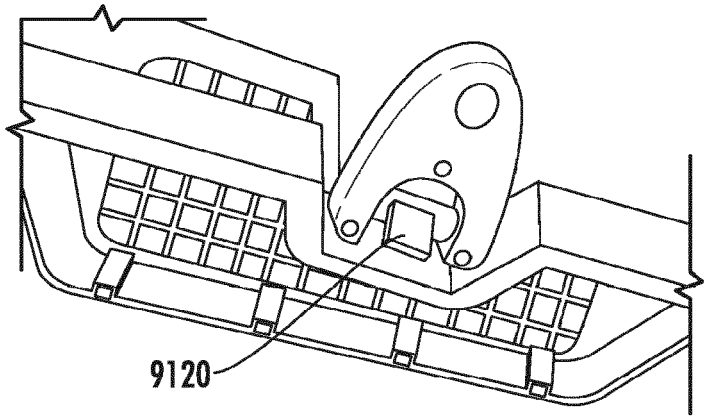


FIG. 12A

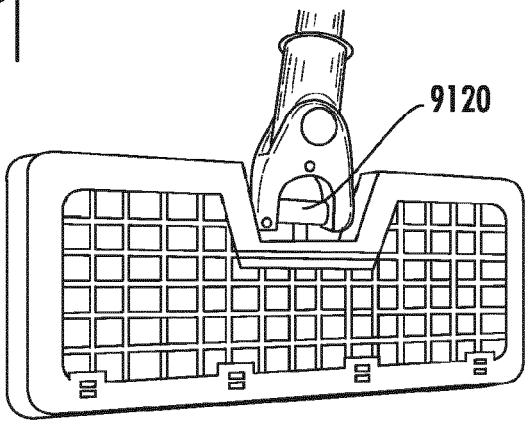


FIG. 12B

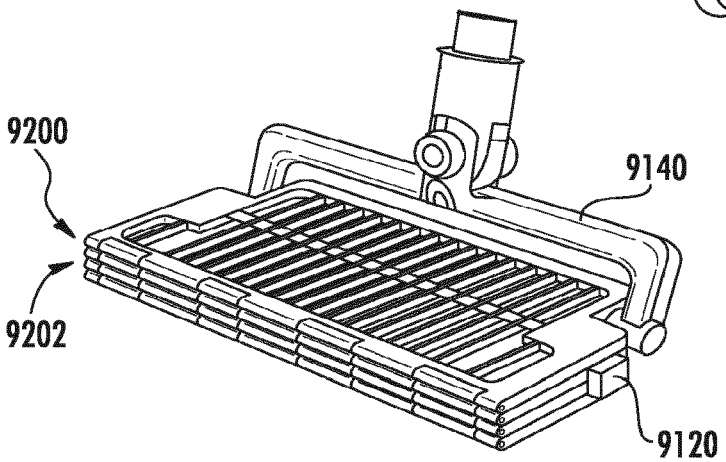


FIG. 12C

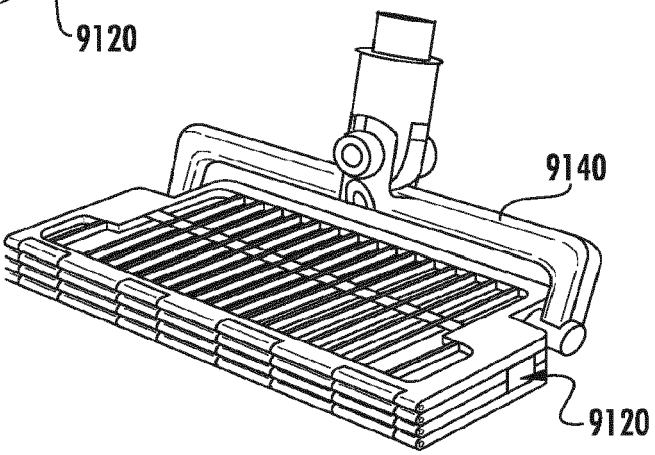


FIG. 12D

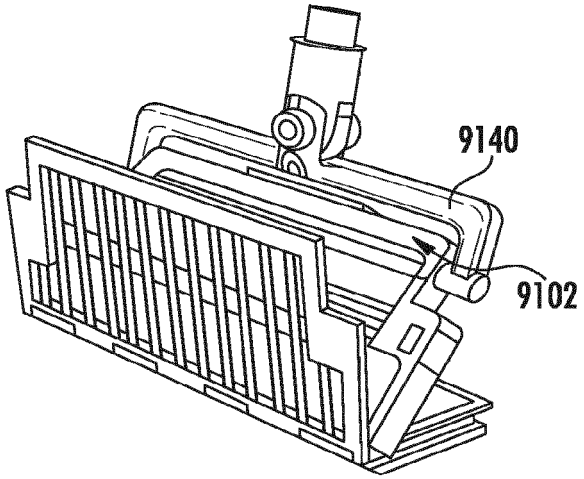


FIG. 12E

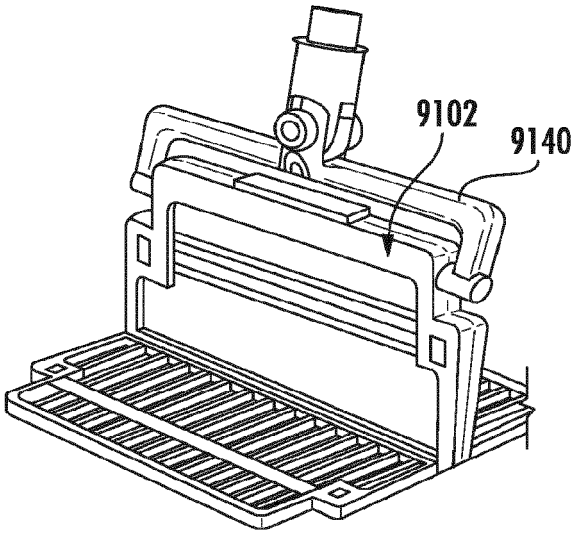


FIG. 12F

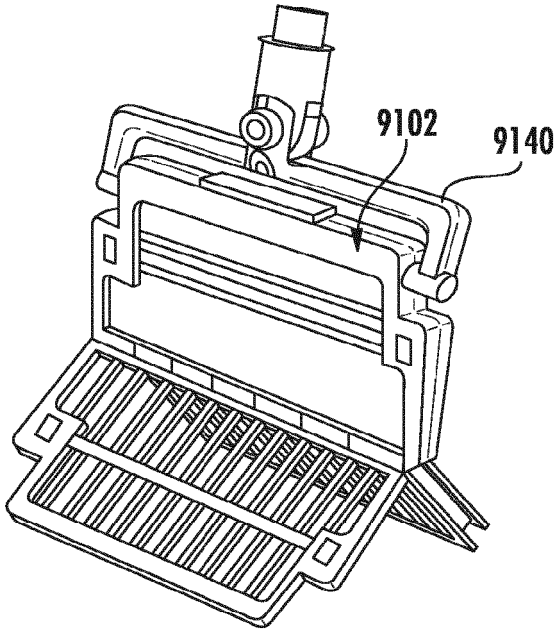


FIG. 12G

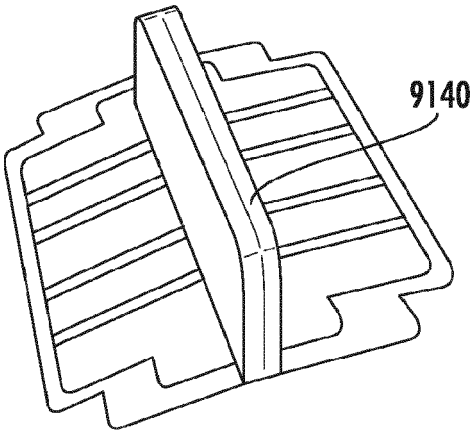


FIG. 12H

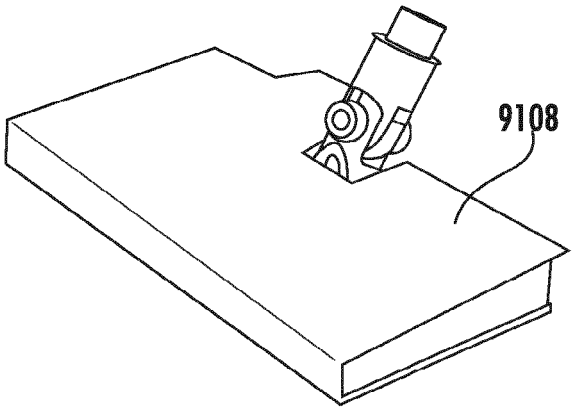


FIG. 13

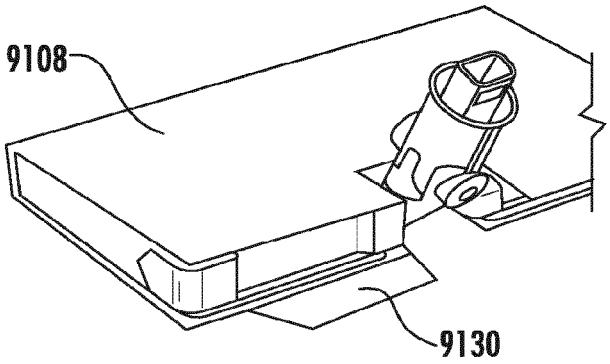


FIG. 13A

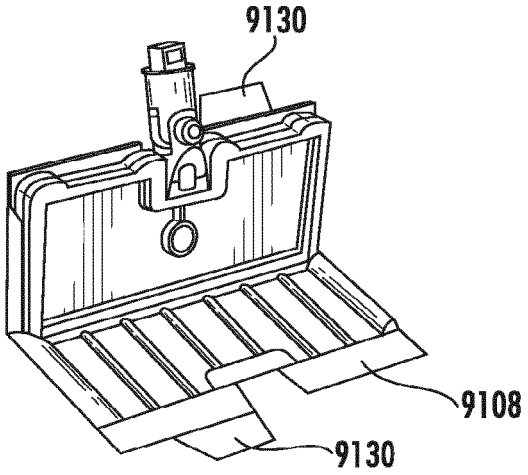


FIG. 13B

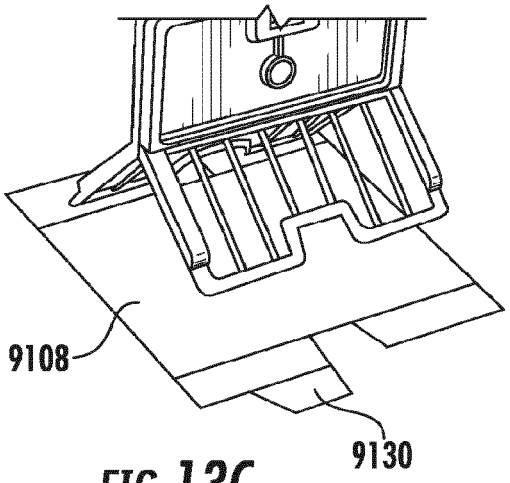


FIG. 13C

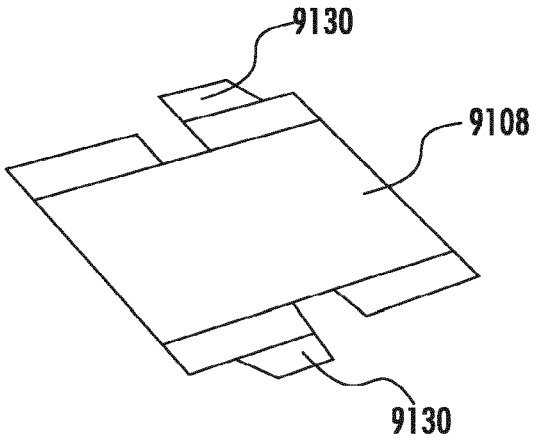


FIG. 13D

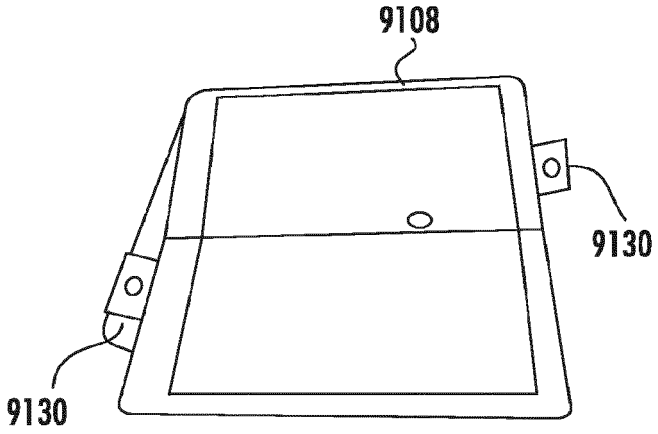


FIG. 13E

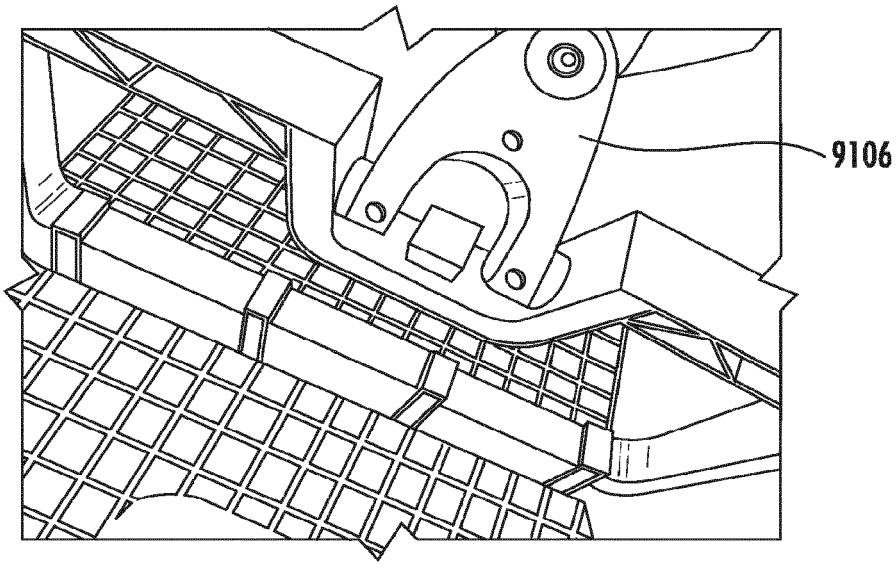


FIG. 14

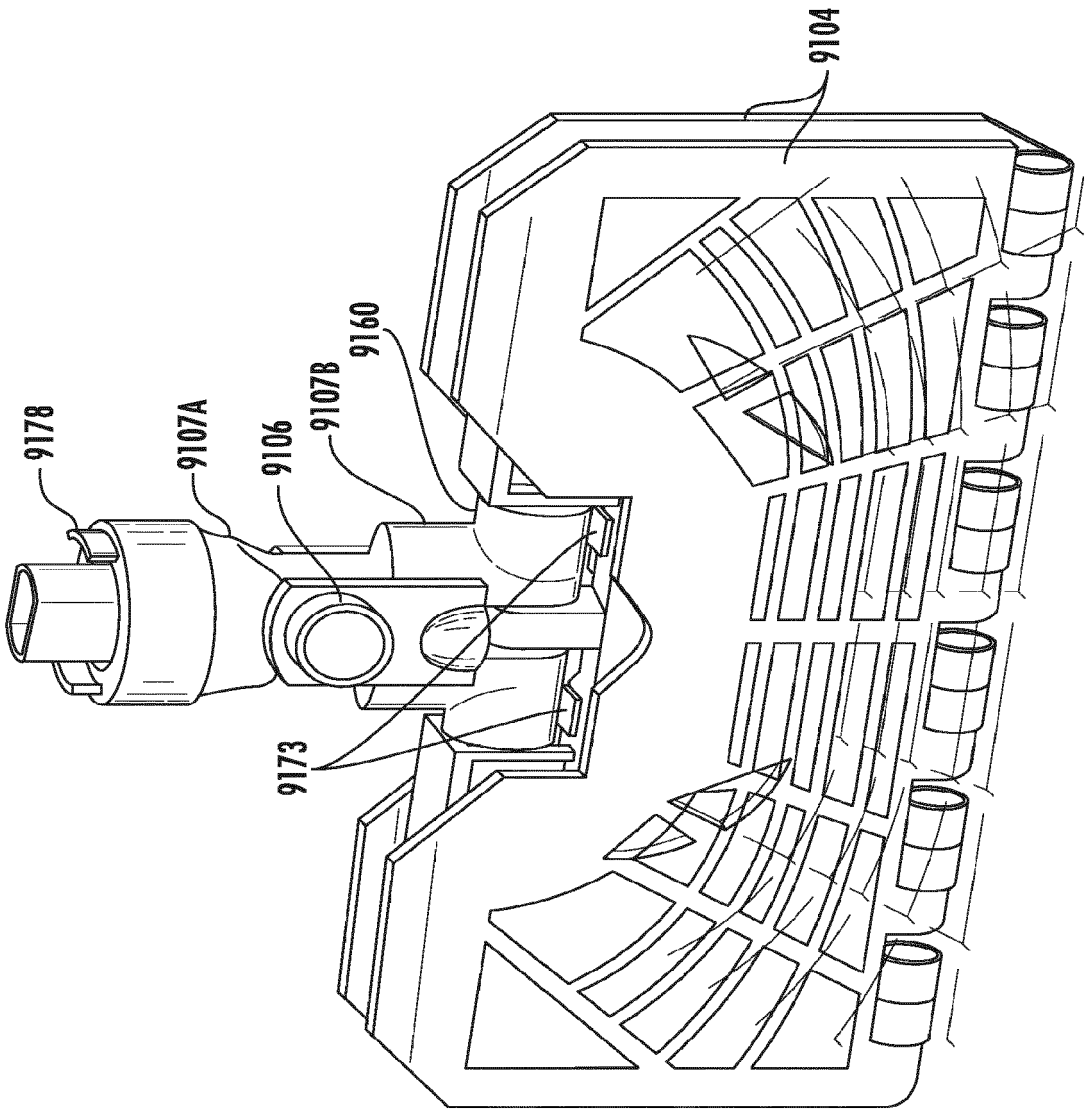


FIG. 15

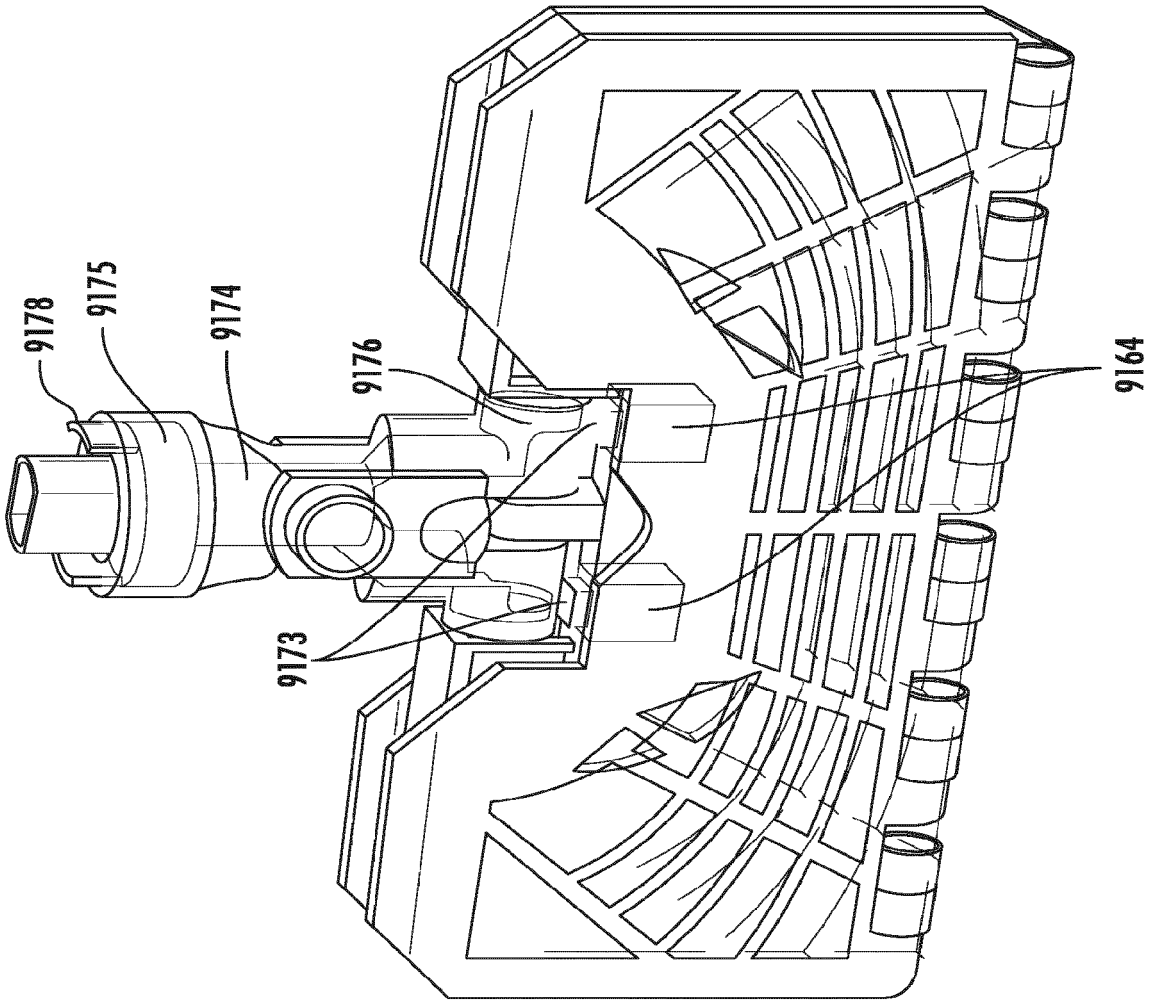


FIG. 15A

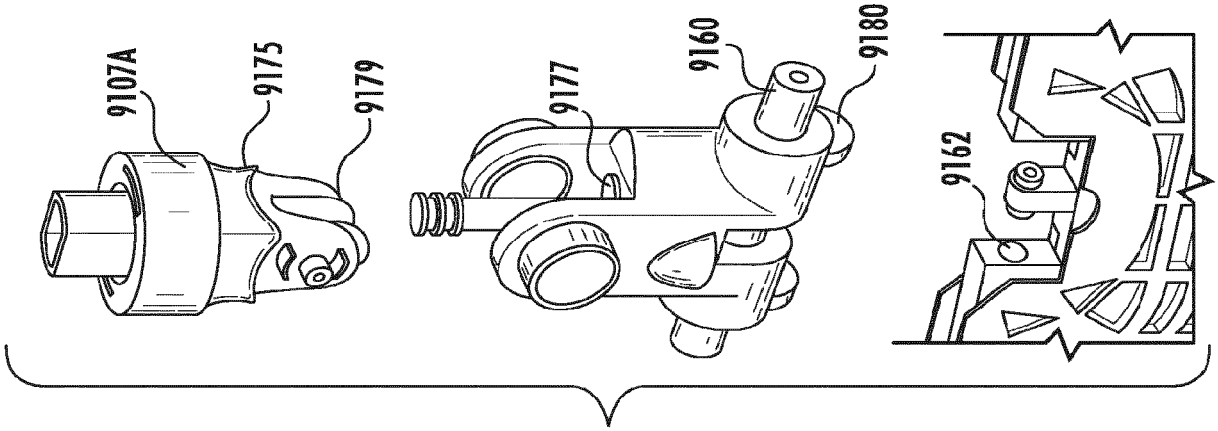


FIG. 15D

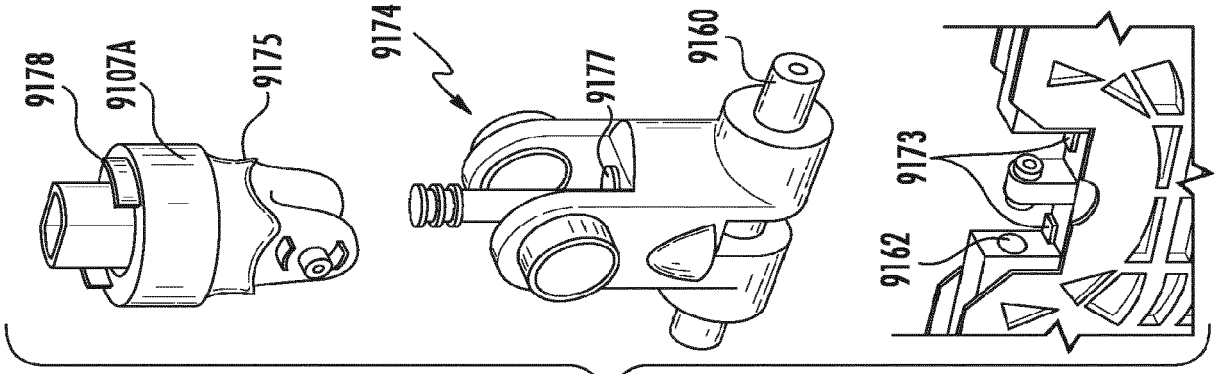


FIG. 15C

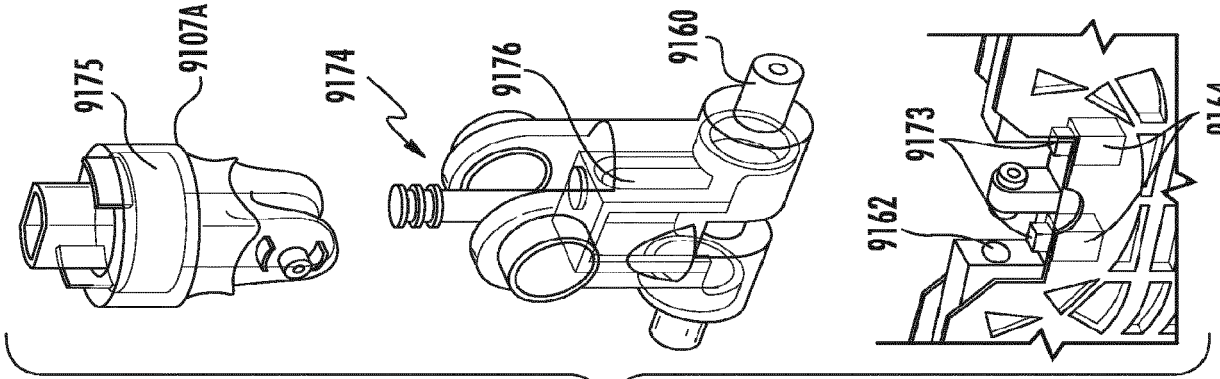


FIG. 15B

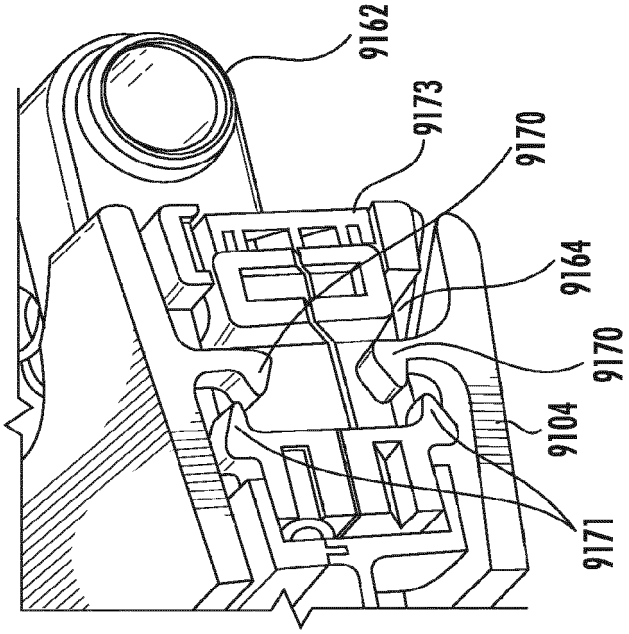


FIG. 15F

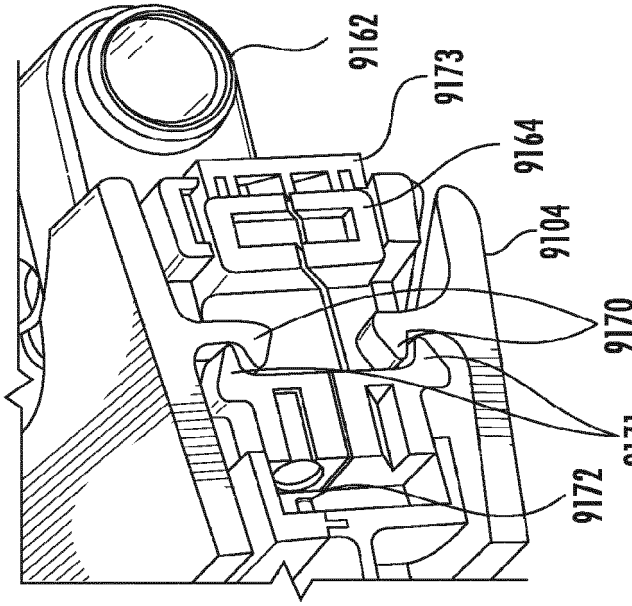


FIG. 15E

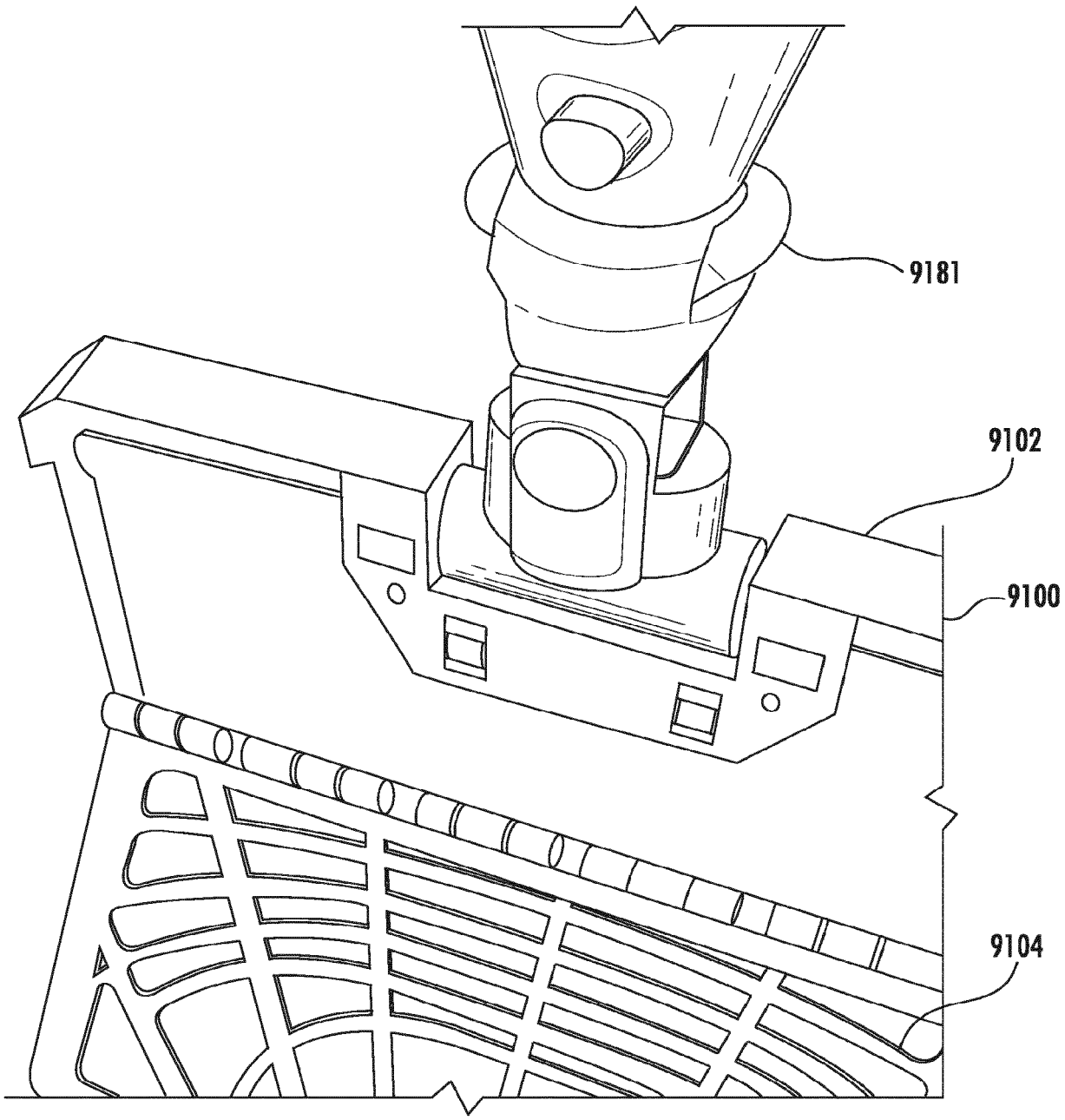


FIG. 16

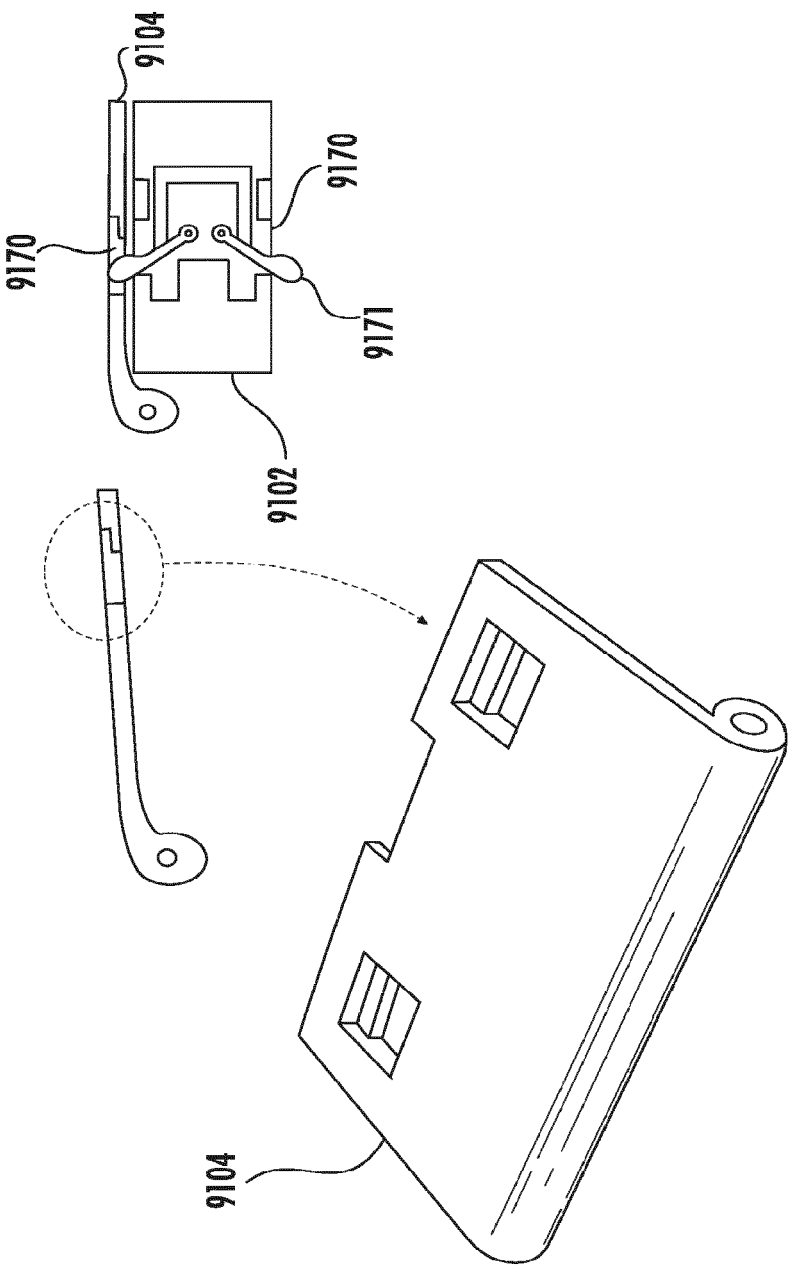


FIG. 16A

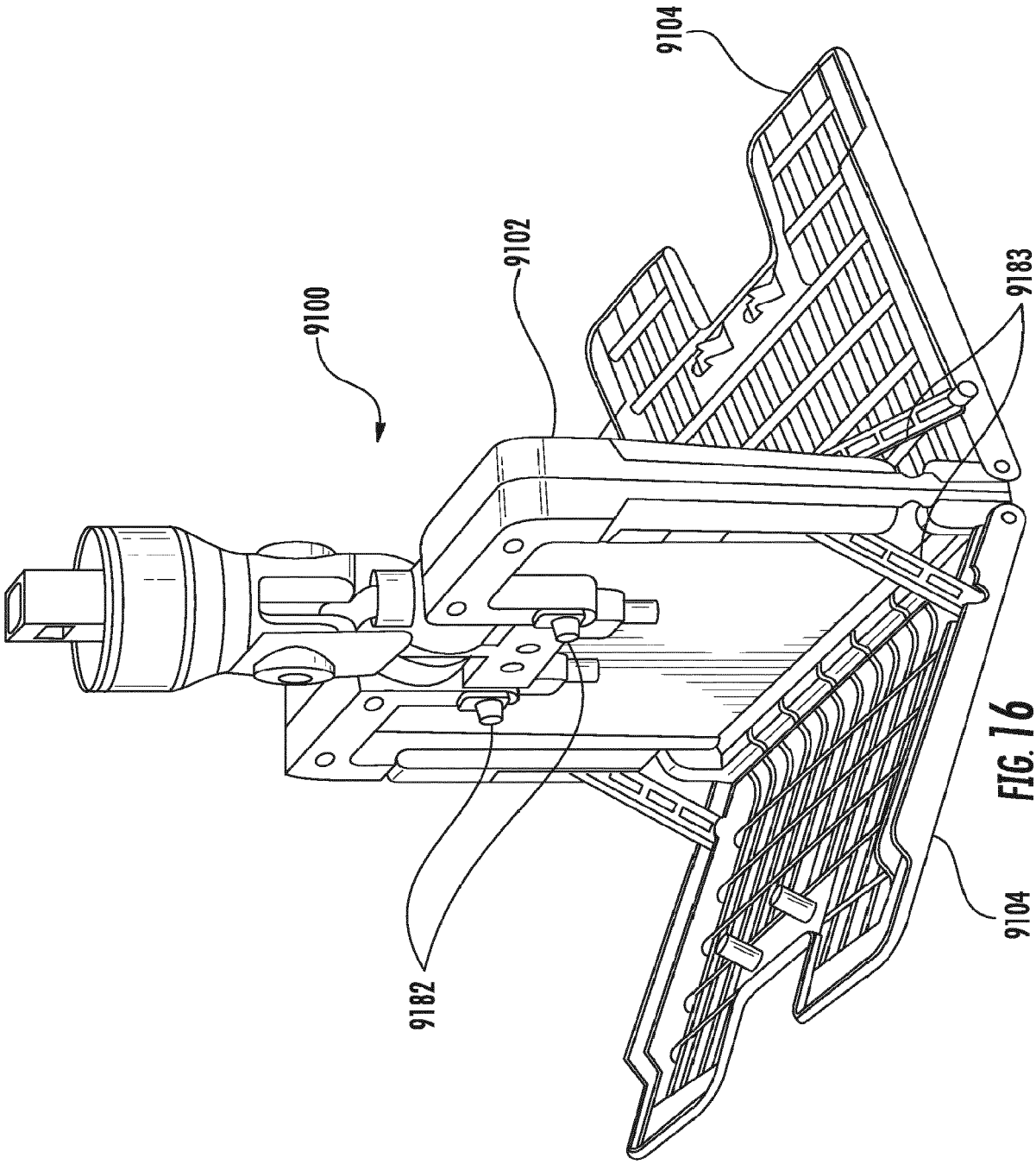
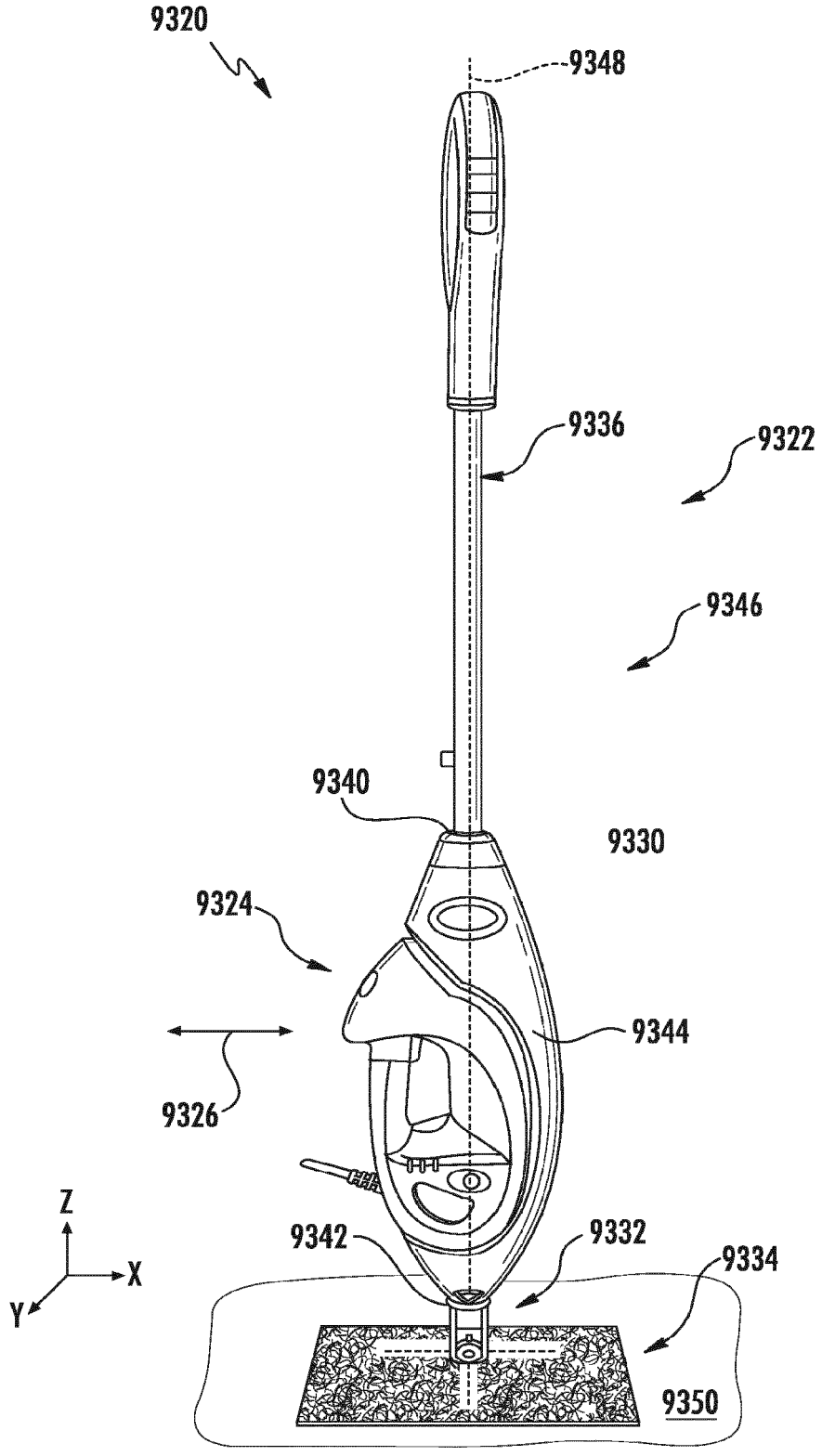


FIG. 16


9320
9348
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9330
9324
9344
9326
Z
X
Y
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9334
9350

FIG. 17

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 62245195 A **[0001]**
- US 62166636 B **[0001]**
- US 8205293 B **[0022]**