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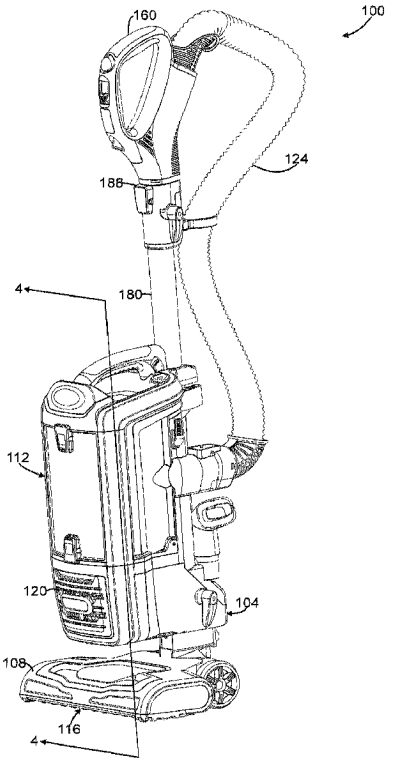

(57) Abrégé/Abstract:
A vacuum cleaner is provided with a handle assembly drivingly connected to the surface cleaning head and a flexible, electrified air flow conduit. A light source disposed on the handle assembly, a main power control, and a brush control controllingly coupled to a brush motor and are provided.

SURFACE CLEANING APPARATUS

[0001] Blank.

FIELD

[0002] This specification relates to a surface cleaning apparatus. In one embodiment, the surface cleaning apparatus, which may be a reconfigurable upright surface cleaning apparatus, includes a flexible, electrified air flow conduit. Various embodiments which use alternate placements of a main power control and a brush control controllingly coupled to a brush motor are provided on the handle assembly. In another embodiment, a light source may be disposed on the handle assembly.

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INTRODUCTION

[0003] The following is not an admission that anything discussed below is part of the prior art or part of the common general knowledge of a person skilled in the art.

[0004] Various types of surface cleaning apparatus are known. Typically, an upright vacuum cleaner includes an upper portion or upper section, including an air treatment member such as one or more cyclones and/or filters, drivingly mounted to a surface cleaning head. An up flow conduit is typically provided between the surface cleaning head and the upper portion. In some such vacuum cleaners, a spine, casing or backbone extends between the surface cleaning head and the upper portion for supporting the air treatment member. The suction motor may be provided in the upper portion or in the surface cleaning head.

[0005] Surface cleaning apparatus having a portable cleaning module that is removably mounted to an upright vacuum cleaner are known. See for example US 5,309,600, US 4,635,315 and US 2011/0314629. US 2011/0314629 discloses an upright vacuum cleaner having a surface cleaning head and an upright section pivotally mounted thereto. A hand vacuum cleaner or a pod is removably mounted on the upper portion and is connected in airflow communication with the surface cleaning head via a flexible hose. A portion of the upper portion is bendable so as to allow the surface cleaning head to extend under furniture. This bendable portion is external to the airflow path. In use, the hand vacuum cleaner is locked on the upper portion. A user may manually unlock the hand vacuum cleaner so as to remove it for use as a hand vacuum cleaner and/or for emptying the cyclone bin assembly. In addition, an above floor cleaning wand may be provided and may be removable with the pod.

SUMMARY

[0006] This summary is intended to introduce the reader to the more detailed description that follows and not to limit or define any claimed or as yet unclaimed invention. One or more inventions may reside in any combination or sub-combination of the elements or process steps disclosed in any part of this document including its claims and figures.

[0007] In accordance with a first aspect there is provided a surface cleaning apparatus having a surface cleaning head and an upper portion moveably mounted to the surface cleaning head between a storage position and a floor cleaning position. A

removable portable cleaning unit may be provided on the upper portion. A brush motor in the surface cleaning head is electrically connected to a power source by a circuit that includes the flexible electrified air flow conduit. A handle assembly drivingly connected to the surface cleaning head has a main power control and a brush control that is controllingly coupled to the brush motor.

[0008] An advantage of this design may be that the main power control and the brush control are located proximate each other and may be located so as to be operable by the same hand as is used to manipulate the surface cleaning apparatus, such as being provided proximate, and optionally on, a handle assembly, and may be on the hand grip portion of the handle assembly. This provides a user with conveniently located controls and enables the user to adjust the mode of vacuuming while continuing to use the vacuum cleaner. Further, the handle assembly may be electrically and fluidically connected to the surface cleaning head by a single step of connecting, e.g., an electrified hose, to the handle assembly, thereby simplifying the steps used by a person when reconfiguring an upright vacuum cleaner.

[0009] In accordance with a second aspect, there is provided a surface cleaning apparatus that includes a surface cleaning head having and an upper portion moveably mounted to the surface cleaning head between a storage position and a floor cleaning position. A removable portable cleaning unit may be provided on the upper portion. A handle assembly drivingly connected to the surface cleaning head has a light source that is electrically connected to a power sorce by an electrified air flow conduit.

[0010] An advantage of this design is that the light source on the handle may be used to illuminate surfaces that are being cleaned, especially when an auxiliary cleaning tool is connected to the handle assembly. In addition, using an electrified air flow conduit to connect the light source to the power source may help simplify the design of the apparatus and may help protect the light source electrical conductors from damage when the apparatus is in use. .

[0011] In accordance with a third aspect, there is provided an upright surface cleaning apparatus that includes a surface cleaning head having a brush driven by a brush motor, and an upper portion that is moveably mounted to the surface cleaning head between a storage position and a floor cleaning position. A portable surface cleaning unit is removably mounted to the upper portion and includes a suction motor

and an air treatment member. An air flow path extends from the cleaning head to the air treatment member and includes a flexible electrified air flow conduit wherein the brush motor is electrically connected to the surface cleaning unit by a circuit that includes the flexible electrified air flow conduit.

[0012] An advantage of this design, is that both air flow communication and electrical communication between the surface cleaning unit and the surface cleaning head may be maintained by the electrified air flow conduit when the surface cleaning unit is removed from the upper portion. This eliminates the need for a separate electrical conductor extending between the surface cleaning unit and the surface cleaning head. This may also help reduce the amount of reconfiguration/reconnection required when removing the surface cleaning unit from the upper portion.

[0013] In accordance with a fourth aspect, an upright surface cleaning apparatus ay includes s handle assembly drivingly connected to a surface cleaning head wherein the handle assembly includes a multi-position brush control electrically coupled to the brush motor by a flexible electrified air flow conduit whereby the brush motor is operable in at least two different modes.

[0014] An advantage of this design is that a user can control the operation of the brush motor using a switch that is provided on the handle. This may eliminate the need for a user to reach down to other portions of the apparatus, such as the surface cleaning head, to control the brush motor. This simplifies the operation of the apparatus and may help facilitate “one handed’ operation, where a user can drive the surface cleaning head and control the brush motor using single hand that is gripping the handle assembly. IN addition, electrically connecting the brush motor to the power source using a circuit that includes the electrified air flow conduit may help simplify the construction of the apparatus and may help protect the brush motor electrical conductors from damage while the apparatus is in use.

[0015] It will be appreciated by a person skilled in the art that a surface cleaning apparatus may embody any one or more of the features contained herein and that the features may be used in any particular combination or sub-combination.

[0016] In particular, the first aspect may be used by itself or one or more of the second, third, and fourth aspects.

[0017] The second aspect may be used by itself or one or more of the first, third, and fourth aspects.

[0018] The third aspect may be used by itself or one or more of the first, second, and fourth aspects.

[0019] The fourth aspect may be used by itself or one or more of the first, second, and third aspects.

[0020] The drawings included herewith are for illustrating various examples of articles, methods, and apparatuses of the teaching of the present specification and are not intended to limit the scope of what is taught in any way.

DRAWINGS

[0021] FIG. 1 is a front perspective view of a surface cleaning apparatus in a storage position;

[0022] FIG. 2 is a rear perspective view of the surface cleaning apparatus of FIG. 1, in the storage position;

[0023] FIG. 3 is a front perspective view of the surface cleaning apparatus of FIG. 1, in a floor cleaning position;

[0024] FIG. 3a is a side elevation view of the surface cleaning apparatus of FIG. 1, in a storage position;

[0025] FIG. 4 is a partial cross-sectional view taken along line 4-4 in FIG. 1;

[0026] FIG. 5 is a rear perspective view of the surface cleaning apparatus of FIG. 1, in a partially disassembled configuration;

[0027] FIG. 6 is a front perspective view of the surface cleaning apparatus of FIG. 1, with the pod removed but still in air flow communication with the surface cleaning head;

[0028] FIG. 7 is a front perspective view of the surface cleaning apparatus of FIG. 1, in an above-floor cleaning configuration;

[0029] FIG. 8 is a rear perspective view of the wand of FIG. 1 disconnected from the upper portion;

[0030] FIG. 9 is a top plan view of the surface cleaning apparatus of FIG. 1, with the wand disconnected from the upper portion;

[0031] FIG. 10 is a rear perspective view of the surface cleaning unit of FIG. 1;

[0032] FIG. 11 is a bottom plan view of the surface cleaning unit of FIG. 1;

[0033] FIG. 12 is a front elevation view of the upper portion and surface cleaning head of FIG. 1;

[0034] FIG. 13 is a cross-sectional view taken alone line 13-13 in FIG. 8;

[0035] FIG. 14 is a rear elevation view of the surface cleaning unit of FIG. 1;

[0036] FIG. 15 is a front perspective view of the handle of FIG. 1;

[0037] FIGS. 16a and 16b are cross sectional views taken along line 16-16 in FIG. 15 showing a brush control in different positions;

[0038] FIG. 17 is a bottom perspective view of the surface cleaning head and the upper portion of FIG. 1;

[0039] FIG. 18 is a front perspective view of the surface cleaning apparatus of FIG. 1, in an above-floor cleaning position;

[0040] FIG. 19 is an abstracted schematic diagram of the electric circuits and conductors of the surface cleaning apparatus of FIG. 1;

[0041] FIG. 20 is an example circuit diagram of the electric circuits and conductors of FIG. 19; and,

[0042] FIG. 21 is an example logic flow diagram executed by one or more processors of the surface cleaning apparatus of FIG. 1.

DESCRIPTION OF VARIOUS EMBODIMENTS

[0043] Various apparatuses or processes will be described below to provide an example of an embodiment of each claimed invention. No embodiment described below limits any claimed invention and any claimed invention may cover processes or apparatuses that differ from those described below. The claimed inventions are not limited to apparatuses or processes having all of the features of any one apparatus or process described below or to features common to multiple or all of the apparatuses described below. It is possible that an apparatus or process described below is not an

embodiment of any claimed invention. Any invention disclosed in an apparatus or process described below that is not claimed in this document may be the subject matter of another protective instrument, for example, a continuing patent application, and the applicants, inventors or owners do not intend to abandon, disclaim or dedicate to the public any such invention by its disclosure in this document.

GENERAL DESCRIPTION OF AN UPRIGHT VACUUM CLEANER

[0044] Referring to FIGS. 1-3, a first embodiment of a surface cleaning apparatus 100 is shown. In the embodiment shown, the surface cleaning apparatus 100 is an upright vacuum cleaner. In alternate embodiments, the surface cleaning apparatus may be another suitable type of surface cleaning apparatus, such as a canister type vacuum cleaner, and hand vacuum cleaner, a stick vac, a wet-dry type vacuum cleaner or a carpet extractor.

[0045] In the illustrated example, the surface cleaning apparatus 100 includes an upper portion or support structure 104 that is movably and drivingly connected to a surface cleaning head 108. A surface cleaning unit 112 is mounted on the upper portion 104. The surface cleaning apparatus 100 also has at least one dirty air inlet 116, at least one clean air outlet 120, and an air flow path or passage extending therebetween. In the illustrated example, the air flow path includes at least one flexible air flow conduit member (such as a hose 124 or other flexible conduit). Alternatively, the air flow path may be formed from rigid members.

[0046] Preferably, as exemplified in FIG. 4, the portable surface cleaning unit 112 includes both the suction motor 128, which may be in a motor housing 132, and an air treatment member, which may be in the form of a cyclone bin assembly 136. The air treatment member may be any suitable air treatment member, including, for example, one or more cyclones, filters, and bags, and preferably the at least one air treatment member is provided upstream from the suction motor Accordingly, surface cleaning unit 112 may be a hand vacuum cleaner, a pod or the like. The cyclone bin assembly 136 includes a cyclone chamber 144 and a dirt collection chamber 148.

[0047] In the embodiment shown, the surface cleaning head 108 includes the dirty air inlet 116 in the form of a slot or opening 152 (FIG. 4) formed in a generally downward facing surface of the surface cleaning head 108. From the dirty air inlet 116,

the air flow path extends through the surface cleaning head 108, and through an up flow conduit 156 (FIG. 2) in the upper portion 104 to the surface cleaning unit 112.

[0048] A handle 160 is provided on a wand that is removably, drivingly connected to the upper portion 104 to allow a user to manipulate the surface cleaning apparatus 100. Referring to FIGS. 2, 3, and 3a, the upper portion extends along an upper axis 164 and is moveably mounted to the surface cleaning head 108. In the illustrated example, the upper portion 104 is pivotally mounted to the surface cleaning head via a pivot joint 168. The pivot joint 168 may be any suitable pivot joint. In this embodiment, the upper portion 104 is movable, relative to the surface cleaning head 108, between a storage position (FIG. 1), and a use or floor cleaning position (FIG. 3). In the floor cleaning position, the upper portion 104 may be inclined relative to the surface being cleaned, and an angle 172 between a plane 176 parallel to the surface and the upper axis 164 may be between about 20° and about 85°. In the storage position (FIG. 3a), the upper portion 104 may be inclined relative to the surface being cleaned, and the angle 172 between the plane 176 parallel to the surface and the upper axis 164 may be between about 85° and 135°.

[0049] It will be appreciated that the forgoing discussion is exemplary and that an upright vacuum cleaner may use a surface cleaning head, the surface cleaning unit and upper portion of any design and they may be moveably connected together by any means known in the art.

[0050] In one aspect, the upright vacuum cleaner 100 may be operable in a variety of different functional configurations or operating modes. The versatility of operating in different operating modes may be achieved by permitting each of the surface cleaning unit 112 and the above floor cleaning wand to be individually to be detachable from the upper portion 104. In the examples illustrated, mounting the surface cleaning unit 112 on the upper portion 104 increases the weight of the upper portion 104 and can affect the maneuverability and ease of use of the surface cleaning apparatus 100. With the surface cleaning unit 112 attached, the vacuum cleaner 100 may be operated like a traditional upright style vacuum cleaner, as illustrated in FIGS. 1-3.

[0051] To enable the vacuum suction generated by the surface cleaning unit 112 to remain in airflow communication with the surface cleaning head 108 when the surface

cleaning unit 112 is detached from the support structure 104, the airflow connection between the surface cleaning head 108 and the cleaning unit 112 is preferably at least partially formed by a flexible conduit, such as flexible hose 124, which may be an electrified hose. Preferably, the hose 124 is extensible and more preferably is elastically or resiliently extensible. The use of a flexible conduit allows a user to detach the surface cleaning unit 112 and maintain a flow connection between the portable surface cleaning unit 112 and the surface cleaning head 108 without having to reconfigure or reconnect any portions of the airflow conduit 184 (FIG. 6).

[0052] In the example shown, the airflow path between the surface cleaning head 108 and the cleaning unit 112 further includes an above floor cleaning wand 180. Wand 180 may be positioned upstream of hose 124 and downstream of surface cleaning head 108. Preferably, wand 180 may be drivingly connected to upper portion 104 so that wand 108 may be used to direct surface cleaning head 108 (e.g., forwardly and rearwardly). Accordingly, wand 180 comprises a rigid airflow conduit having any suitable shape. For example, wand 180 may be straight as shown or it may be curved or bent. In some embodiments, wand 180 may be reconfigurable. For example, wand 108 may have upper and lower sections that are moveably mounted with respect to each other (e.g., pivotally connected) so that wand 180 may be converted from a straight configuration to a bent configuration. Further, wand 180 may have any suitable cross-sectional shape, such as a circular cross-section as shown, or another cross-sectional shape such as square, triangular, or another regular or irregular shape, such as egg-shaped.

[0053] Wand 180 may be telescopic so that it is extendable.

[0054] In order to enable a user to use wand 180 to remotely maneuver surface cleaning head 108, wand 180 may be provided with a handle assembly. Preferably, handle assembly or handle 160 is positioned proximate an upper (i.e. downstream) end 188 of wand 180. For example, handle 160 may be connected to one or both of wand 180 and hose 124. Optionally, handle 160 may form part of the airflow path between wand 180 and hose 124. Alternatively, handle 160 may be peripherally attached to one or both of wand 180 and hose 124 without participating in the airflow communication between wand 180 and hose 124.

[0055] A user may grasp a hand grip portion 182 of handle 160 to manipulate wand 180 (e.g. for moving upper portion 104 and steering surface cleaning head 108). In alternative embodiments, surface cleaning apparatus 100 may not include a handle 160 and instead a user may grasp wand 180 directly.

[0056] Reference is now made to FIG. 5. As shown, upper portion 104 is moveably mounted with respect to surface cleaning head 108. Upper portion 104 may be connected to surface cleaning head 108 by any means known in the art, (e.g., it may be pivotally mounted, rotationally mounted or the like). As exemplified, pivot joint 168 permits upper portion 104 to tilt and/or pivot with respect to surface cleaning head 108.

[0057] As exemplified, each of wand 180 and surface cleaning unit 112 is selectively attachable or detachable from upper portion 104. An advantage of this design is that a user may convert the vacuum cleaner to a surface cleaning mode by removing the wand without having to remove surface cleaning unit 112. Preferably, each of wand 180 and surface cleaning unit 112 may be selectively connected or disconnected from upper portion 104 independently of the other. For example, wand 180 and surface cleaning unit 112 may be connected or disconnected from upper portion 104 in any order, sequentially or simultaneously. This may simplify the reconfiguration of surface cleaning apparatus 100 into different cleaning modes without requiring disruption to the operation of surface cleaning apparatus 100.

[0058] As exemplified, when upstream end 192 of wand 180 is connected to upper portion 104, the surface cleaning head 108 participates in the airflow path in a floor cleaning mode, e.g., for cleaning floors, stairs, and the like. In such a case, the surface cleaning unit 112 may be mounted on upper portion 104, for supporting the weight of surface cleaning unit on upper portion 104 (e.g., as shown in FIG. 3 which exemplifies a traditional floor cleaning mode for an upright vacuum cleaner). Alternately, surface cleaning unit 112 may be dismounted from upper portion 104 and carried by hand, worn as a backpack, or placed on the floor for example while wand 180 is connected to surface cleaning head 108 (e.g., as shown in FIG. 6 which exemplifies an alternate floor cleaning mode for an upright vacuum cleaner).

[0059] As exemplified, wand 180 may be disconnected from upper portion 104 for use in an above-floor cleaning mode. In one embodiment, surface cleaning unit 112 may be mounted on upper portion 104, for supporting the weight of surface cleaning unit on

upper portion 104 while wand 180 is used in the above floor cleaning mode (e.g., as shown in FIG. 7). Alternately, in another optional embodiment, surface cleaning unit 112 may also be dismounted from upper portion 104 and carried by hand, worn as a backpack, or placed on the floor for example while wand 180 is used in the above floor cleaning mode.

[0060] Wand 180 and surface cleaning unit 112 may connect to upper portion 104 in any suitable fashion. In the example shown, wand 180 is inserted into upper portion 104, and surface cleaning unit 112 is mounted to an exterior of upper portion 104. In such a case, upper portion 104 may provide part or all of the air flow path from surface cleaning head 108 to wand 180. In other embodiments, upper portion 104 need not be part of the air flow path. For example, wand 180 may be mounted to the exterior of upper portion 104 and the inlet end may seat on an outlet end of a duct provided on the outer surface of the upper portion 104.

[0061] Referring to FIG. 6, when the surface cleaning apparatus 100 is in use, a user may detach the surface cleaning unit 112 from the upper portion 104 without interrupting the airflow communication between the cleaning unit 112 and the surface cleaning head 108. This allows a user to selectively detach and re-attach the cleaning unit 112 to the support structure 104 during use without having to stop and reconfigure the connecting hose 124 or other portions of the airflow conduit 184. As exemplified, wand 180 is attached to upper portion 104 and surface cleaning unit 112 is detached from upper portion 104.

[0062] In this configuration, upper portion 104 may provide a connection between wand 180 and surface cleaning head 108, which may permit surface cleaning head 108 to be driven by manipulating wand 180.

[0063] In addition to being operable to clean floors or surfaces, the vacuum cleaner may be operated in a variety of cleaning modes that do not include use of the surface cleaning head, and may be generally described as above floor cleaning modes. This can generally include cleaning furniture, walls, drapes and other objects as opposed to cleaning a large, planar surface.

[0064] In one example of an above floor cleaning mode, as exemplified in FIG. 7, the surface cleaning unit 112 can remain mounted on the upper portion 104. This eliminates the need for the user to separately support the weight of the surface cleaning

unit 112 in an above floor cleaning mode. In the illustrated configuration, the surface cleaning unit 112 may remain mounted on the upper portion 104 and the wand 180 may be detached from upper portion 104 to provide an extended reach for above floor cleaning. Optionally, additional accessory tools may be coupled to the upstream end 192 of wand 180, including for example a crevice tool, a cleaning brush (optionally an electrically powered brush or an air driven turbo brush) and any other type of accessory including a power tool such as a sander.

[0065] Further, as illustrated in FIG. 5, the upstream end 200 of the handle 160 may be separated from the downstream end 188 of wand 180. In this configuration the upstream end 200 of the handle 160 can function as the dirty air inlet for the vacuum cleaner 100. Optionally, accessory tools, such as wands, crevasse tools, turbo brushes, hoses or other devices may be coupled to the upstream end 200 of the handle 160.

[0066] In another example of an above floor cleaning mode, as exemplified in FIG. 5, the surface cleaning unit 112 and wand 180 can both be detached from the upper portion 104. The upstream end 200 of handle 160 may be selectively connected or disconnected from downstream end 188 of wand 180 as desired. This configuration may be advantageous when surface cleaning unit 112 must be held above the floor (e.g. while the user is standing on a ladder). In this case, the upper portion 104 and surface cleaning head 108 may add unnecessary weight to the surface cleaning unit 112.

[0067] Reference is now made to FIG. 5. Surface cleaning unit 112 may be removably mountable to one or more of upper portion 104 and wand 180. Preferably, surface cleaning unit 112 may be mounted to upper portion 104 independent of wand 180, such that surface cleaning unit 112 may be mounted and dismounted from upper portion 104 without adjusting the position of wand 180 or removing wand 180. Accordingly, for example, wand 180 may remain in upper portion 104 while surface cleaning unit 112 is mounted to or removed from upper portion 104.

[0068] Alternately, or in addition, when surface cleaning unit 112 is mounted to upper portion 104, upper portion 104 may stabilize surface cleaning unit 112 (e.g. surface cleaning unit 112 may remain in a fixed position on upper portion 104 as upper portion 104 is manipulated to maneuver surface cleaning head 108). For example, upper portion 104 may inhibit translational movement of surface cleaning unit 112 along

upper axis 164 (FIG. 2) toward surface cleaning head 108, and/or may inhibit rotational movement of surface cleaning unit 112 around upper axis 164.

[0069] The surface cleaning unit 112 may be mounted on the exterior of upper portion 112 by two spaced apart mounting members Optionally, the surface cleaning unit 112 may have one or more recesses to slidably receive on one or both of the mounting members.

[0070] Referring to FIGS. 10-13, in the illustrated example the upper portion 104 includes mounting members in the form of outwardly projecting wings 1174a and 1174b that extend laterally from a front side 1178 of upper portion 104. Although upper portion 104 is shown including two mounting members, in alternative embodiments, upper portion 104 may include any suitable number of mounting members.

[0071] The surface cleaning unit 112 includes recesses 1182a and 1182b each of which has an opening 1186 in a bottom surface 1190 of surface cleaning unit 112 to receive wings 1174.

[0072] The engagement between wings 1174 and recesses 1182 may stabilize surface cleaning unit 112 from rotating in all directions. This may prevent surface cleaning unit 112 from tipping over, e.g. when upper portion 104 is manipulated to maneuver surface cleaning head 108. Further, wings 1174 may support surface cleaning unit 112 from translating toward surface cleaning head 108.

[0073] Reference is now made to FIGS. 10, 12, and 14. In addition to, or instead of wings 1174 and recesses 1182, surface cleaning unit 112 may include a different mounting member that engages downstream end 1010 of upper portion 104. As exemplified, surface cleaning unit 112 may include another mounting member in the form of a clip 1206. Clip 1206 may extend downwardly in spaced apart relation from a rear surface 1210 of surface cleaning unit 112 forming a slot 1214 for receiving a portion of downstream end 1010 of upper portion 104.

[0074] In use, surface cleaning unit 112 may be lowered onto upper portion 104 such that a front side 1178 of downstream portion 1006 enters slot 1214, and clip 1206 enters upper portion 104. Clip 1206 may grasp front side 1178 of upper portion 104 to inhibit surface cleaning unit 112 from rotating forwardly, over surface cleaning head 108, or rearwardly. Reference is now made to FIGS. 8, 9, 10, and 14. Alternatively, or in

addition to wings 1174, recesses 1182, and clip 1206, the wand 180 may include mounting members for supporting surface cleaning unit 112 and or dynamically stabilizing or assisting in dynamically stabilizing surface cleaning unit 112 on upper portion 104.

[0075] In the illustrated example, the wand 180 includes mounting members in the form of wings 1226a and 1226b and the surface cleaning unit 112 has arms 1230a and 1230b for at least partially surrounding wings 1226. As shown, each arm 1230 has an open ended a slot 1234 for receiving a corresponding wing 1226 from above or below slots 1234. For example, if surface cleaning unit 112 is connected to upper portion 104, then wings 1226 may enter and exit slots 1234 through the open upper end 1238 of slots 1234, as wand 180 is lowered into upper portion 104 or raised away from upper portion 104. Further, if wand 180 is connected to upper portion 104, then wings 1226 may enter and exit through slots 1234 through the open bottom end 1242 of slots 1234, as surface cleaning unit 112 is lowered onto upper portion 104 or raised away from upper portion 104.

[0076] As exemplified, each of wings 1226 includes a front surface 1250 that faces forward toward surface cleaning unit 112 (when surface cleaning unit 112 and wand 180 are connected to upper portion 104), and an opposite rear face 1254. In use, when wings 1226 are received in slots 1234, slots 1234 may contact at least a portion of rear faces 1254 of wings 1226. This may permit arms 1230 to inhibiting surface cleaning unit 112 from tilting forwardly over surface cleaning head 108.

BRUSH CONTROL

[0077] The following is a description of a brush control that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed herein, for example with one or more of the first, second, third and fourth aspects.

[0078] Reference is now made to FIG. 17. In some embodiments, surface cleaning apparatus 100 includes an electrically powered peripheral device, other than a suction motor. For example, surface cleaning head 108 may include a power brush 2034. Power brush 2034 may include a plurality of bristles 2038 which are driven by a brush motor 3094 (e.g. an electric motor) 3094 as shown in FIG. 19 to rotate about an axis of rotation 2042. In use, bristles 2038 may be positioned to contact the surface to

be cleaned, in order to dislodge and collect dirt and hair. The brush drive motor may be drivingly connected to the brush by any means known in the surface cleaning arts, such as a belt drive or direct drive.

[0079] Generally, it is recommended to use a power brush on certain surface types, such as carpet which may retain dirt and hair more persistently, and to disable the power brush for certain other surface types, such as hard surfaces (e.g. hardwood or tiles) where the bristles may deflect dirt away from the dirty air inlet or scratch the surface. Further, it may be recommended to change the speed of the power brush (i.e. the rotary speed of the bristles) to a faster speed for certain surface types (e.g. thick carpet) than for other surface types (e.g. short carpet).

[0080] Reference is now made to FIGS. 16a-16b, 17, 18 and 19. In some embodiments, the surface cleaning apparatus 100 may include a control member operably connected to adjust the speed of the brush. The control member may be operably connected to the brush drive motor or to a transmission member positioned between the brush drive motor and the brush to selectively activate and/or control the speed of the power brush. This may permit a user to selectively activate, deactivate, speed up or slow down the power brush according to the surface type to be cleaned. The control member may be mechanically, electrically, or electromechanically coupled to the brush motor controlling the speed of the power brush. Examples of suitable control members include dials, switches, levers, slides, buttons, and touch-screens.

[0081] As exemplified, handle 160 includes a brush control 3026. Brush control 3026 is an example of a suitable control member. Brush control 3026 may be electrically coupled to the brush motor of power brush 2034 in any suitable manner, such as by way of an electrical connector or by way of one or more conductors as shown, for example, in FIG. 19. In the example shown, brush control 3026 is movable between at least an off position as shown in FIG. 16b and a high speed position as shown in FIG. 16a. In some cases, brush control 3026 includes, or is mechanically coupled to, a multi-position switch 3020, and may also have one or more intermediate selectable positions in addition to the off and high speed positions shown, such as a medium speed. In some embodiments, brush control 3026 is infinitely positionable between the off and high speed positions shown for selecting a speed within a continuous spectrum from off to

high speed. In use, a user may move brush control 3026 from the off position to any other non-zero speed position to operate the power brush at the selected speed.

[0082] In the illustrated embodiments, multi-position switch 3020 can be positioned electrically downstream from a main power control 3014. Multi-position switch 3020 is provided in electrical communication between the main power control 3014 and the surface cleaning head 108 and, in particular, brush motor 3094. In this configuration, the supply of power to the surface cleaning head 108 and brush motor 3094 may be controlled via the multi-position switch 3020 and one or more processors and circuits as exemplified herein with reference to FIGS. 19 and 20. This allows the surface cleaning head 108 to be selectively energized or de-energized while the surface cleaning unit 112, and the suction motor 128 therein, remain energized. Using the multi-position switch 3020, a user may, e.g., control the rotating brush within the surface cleaning head when cleaning one surface (e.g. a thick carpet), may control the rotating brush within the surface cleaning head to rotate at a lower or intermediate speed when cleaning another surface (e.g., a short carpet) and may turn off the rotating brush when cleaning another surface (e.g. a non-carpeted floor such as a tile or hardwood floor) without interrupting the suction supplied by the surface cleaning unit 112.

[0083] The multi-position switch 3020 may be located at any position that is electrically connected to the main power control 3014 and the surface cleaning head 108. In the illustrated embodiment, the multi-position switch 3020 is provided on the handle 160, and is generally adjacent the hand grip portion 182 and may be on the hand grip portion 182. This may allow a user to operate the brush control 3026 and thus control the power brush during use, such as by changing the position of brush control 3026, as the cleaning surface type changes (e.g., using the same hand as is moving surface cleaning head 108 using handle 160). For example, brush control 3026 may be positioned on the handle 160 so that it is operable by a user's hand, while the user uses the hand to direct the surface cleaning head. Alternatively, the auxiliary power switch may be provided in another location, including, for example on the surface cleaning unit, on the surface cleaning head, on the upper or lower wand portion, on the hand grip, or on the cuff or other portion of the hose 124.

[0084] In some embodiments, an indicator 3010 may be provided adjacent brush control 3026, with visual markings which communicate a correspondence between the

different positions of brush control 3026 and the speed of power brush 2034. For example, visual markings may be provided for OFF, LOW SPEED, and HIGH SPEED. Alternatively or in addition, the visual markings may communicate a correspondence between the different positions of brush control 3026 and the recommended surface type for the corresponding speed. For example, visual markings may be provided for HARD FLOOR (at the off position), SHORT CARPET (at the medium or intermediate speed position), and THICK CARPET (at the high speed position).

[0085] In some embodiments, the indicator may be illuminated, for example using LEDs. For example, a backlight LED may be provided to align with the selected position of the brush control 3026 when the multi-position switch is moved by the user. In another example, separate backlight LEDs for each position of the brush control 3026 may be selected enabled or disabled, for example by a handle control processor, when the switch is moved.

MAIN POWER CONTROL

[0086] The following is a description of a main power control that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed herein, including, for example, with one or more of the first, second, third and fourth aspects.

[0087] The surface cleaning apparatus 100 may include a main power control or master on/off electrical switch 3014 that controls the supply of power received from the wall socket (or any other type of power source that is connected to the surface cleaning unit, including, for example, a battery). Preferably, the main power control 3014 controls the supply of power to the suction motor 128, brush motor 3094 and other components within the surface cleaning apparatus 100. Accordingly, main power control 3014 may be used to turn all electrical components on or off, or if a component has an individual on/off control switch such as brush control 3026, main power control 3014 may energize a circuit including the individual on/off control switch. In some embodiments, and as described further with respect to FIGS. 19 and 20, main power control 3014 is interposed in series with one or more hot conductors, which allows the main power control 3014 to be provided in handle 160, wand 180, hose 124, surface cleaning head 108 or surface cleaning unit 112.

[0088] When the main power control 3014 is off, the surface cleaning unit 112 (and the hose 124, surface cleaning head 108 and other components) may be de-energized. When the main power control 3014 is on, the surface cleaning unit 112 (and hose 124, surface cleaning head 108, etc.) may be energized.

[0089] Main power control 3014 may be located at any position. Preferably, main power control 3014 is located on or adjacent the handle 160 to provide easy user access while operating the surface cleaning apparatus 100. For example, main power control 3014 may be provided at a location that is operable by the same hand of a user that is user to move the surface cleaning head 108 using handle 160. Accordingly, for example, the control member may be provided on hand grip portion 182. In this way, a user may use, e.g., their thumb to adjust the control while vacuuming.

[0090] As exemplified, handle 160 includes a main power control 3014. Main power control 3014 may be electrically coupled to the suction motor 128 of surface cleaning unit 112 and the brush motor 3094 of power brush 2034 in any suitable manner, such as by way of an electrical connector or by way of one or more conductors as shown, for example, in FIGS. 19 and 20. In the example shown, main power control 3014 is a toggle switch movable between an off position and on position. In some cases, main power control 3014 may be a slider switch or other suitable switch.

[0091] In the illustrated embodiments, main power control 3014 may be interposed between a hot conductor 3510 of an AC electrical plug and a power control conductor 3550 for controlling a suction motor relay circuit 3090. In this configuration, the supply of power to the suction motor 128 may be controlled via the main power control 3014, which may be located in the handle 160. This allows the surface cleaning unit 112 to be selectively energized or de-energized from the handle by a user while grasping the hand grip, and without requiring the user to locate a power control on the surface cleaning unit 112 or surface cleaning head 108.

ELECTRIFIED HOSE

[0092] The following is a description of an electrified, stretchable suction hose that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed herein, including, for example, with one or more of the first, second, third and fourth aspects. Advantageously, an electrified hose may be mounted directly or indirectly to a surface

cleaning unit 112 and removable therewith from upper portion 104. Accordingly, when the surface cleaning unit is used in a hand carriable configuration, the electrified hose may still be electrified and used to power a tool or handle 160.

[0093] In at least some embodiments, hose 124 may include one or more electrical conductors (e.g. wires) that can carry electrical power and/or control or data signals between the upstream and downstream ends of the hose. Optionally, the conductors within the hose may be limited to carrying electrical power and the transmission of control or data signals may be accomplished using another suitable means. For example, the means for transmitting the control or data signals may be a wireless transmitter, which may help reduce the need to provide separate data conductors in addition to the hose.

[0094] Upstream or downstream ends of hose 124 may include multi-conductor connectors that are mateable with corresponding multi-conductor connectors of surface cleaning unit 112 or handle 160. In the illustrated example of FIGS. 10 and 19, a downstream end of hose 124 has a multi-conductor connector 3042, in which male push-type connectors for each of the respective conductors of hose 124 are provided. Multi-conductor connector 3042 is mateable with a multi-conductor connector 3038 of surface cleaning unit 112, which has female push-type connectors corresponding to the male connectors of multi-conductor connector 3042. It will be appreciated that the male-female relationship may be reversed, or connectors of other suitable types may be used.

[0095] Providing electrical conductors within the hose 124 may allow the hose to transmit electrical signals (power and/or control signals) between its upstream and downstream ends. Optionally, the conductors may be attached to the inner surface of the hose (i.e. within the air flow path), attached to the outer surface of the hose or incorporated within the sidewall of the hose 124. This may eliminate the need for a separate wire or other power transfer apparatus to be provided in addition to the hose and/or to run in parallel with the hose. Reducing the need for external power or control wires may reduce the chances that the exposed electrical wires may be damaged, unintentionally disconnected during use or otherwise compromised.

[0096] Providing electrical conductors within the hose 124 may allow the hose 124 to serve as a primary, and optionally only, electrical connection between the surface cleaning unit 112 and the surface cleaning head 108 (or any other portion of the vacuum

cleaner that is connected to an external power supply) and the rest of the vacuum cleaner upstream from the hose. Optionally, in configurations in which the surface cleaning unit 112 is the only portion of the vacuum cleaner connected to the electrical power cord which is plugged into the wall, the hose 124 may serve as the primary electrical conduit for carrying power and/or control signals to the surface cleaning head 108, a plurality of cleaning tools, auxiliary tools, lights, sensors, power tools and other components that are connected to the upstream end of the hose 124 and used in combination with the surface cleaning unit. For example, as exemplified, hose 124 may be wired in series with wand 108 and therefore hose 124 and wand 180 (and optionally handle 160 to which each of hose 124 and wand 180 may be removably connected) may be used to provide power from surface cleaning unit 112 to surface cleaning head 108.

[0097] In an example embodiment, surface cleaning unit 112 is connected to the source of power. Accordingly hose 124 is used to carry a power control signal used to energize surface cleaning unit 112. In addition, hose 124 is used to carry a power control signal and power to energize surface cleaning head 108. In other embodiments, hose 124 may perform only one or two of these functions.

[0098] It will be appreciated that transmitting power via the hose 124 will allow the hose to be used to supply power to cleaning tools and/or other power tools which may eliminate the need to provide a separate power connection for the tools or to require the use of batteries or an air turbine. For example, using an electrified hose to supply electrical power may allow the surface cleaning head 108 to be powered in a variety of different cleaning configurations, including those in which the surface cleaning unit 112 is removed from upper portion 104.

[0099] In some embodiments, some or all of the wand 180 may also be configured to include conductors corresponding to those of hose 124, to transmit power and/or signals. This may help provide an electrical connection between the hose, e.g., upstream end of the hose 124, and other portions of the vacuum cleaner.

[00100] Referring now to FIGS. 1 and 19, the handle 160 and surface cleaning unit 112 are provided with electrical connections via conductors and connectors. Providing electrical connections between the portions of the apparatus allows power to be transmitted from the surface cleaning unit 112 to the handle 160 and on to the surface

cleaning head 108 (for example to power a rotating brush assembly) via the wand 180 and without the need for a separate electrical wire or connection.

[00101] In the example embodiment of FIGS. 19 and 20, a power control circuit 3002 is provided in surface cleaning unit 112. Power control circuit 3002 has three conductors connected via a multi-conductor connector to respective conductors of hose 124: a hot conductor 3510, a neutral conductor 3520 and a power control conductor 3550b. Hose 124 carries the hot, neutral and power control conductors, each of which is connected using a multi-conductor connector to a respective conductor of the handle control circuit 3102.

[00102] Handle control circuit has a main power control 3014 interposed in a hot conductor 3510b. A power control conductor 3550a is tied to the downstream portion of hot conductor 3510b, such that it can only be energized when the main power control 3014 is on (e.g., switch is closed). When main power control 3014 is on, power control conductor 3550a also becomes 'hot' and energizes power control circuit 3002. Power control circuit 3002 includes a suction motor relay circuit 3090 which is activated when power control conductor 3550a and 3550b are energized, and operates to close a relay, allowing suction motor 128 to become energized.

ELECTRIFIED WAND

[00103] The following is a description of an electrified wand that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed herein, including, for example, with one or more of the first, second, third and fourth aspects. Advantageously, an electrified wand may be mounted directly or indirectly to a surface cleaning unit 112 and removable therewith from a base. The electrified wand may be used to power a tool or surface cleaning head 108.

[00104] In at least some embodiments, wand 180 may include one or more electrical conductors (e.g. wires) that can carry electrical power and/or control or data signals between the ends of the hose. Optionally, the conductors within the wand may be limited to carrying electrical power and the transmission of control or data signals may be accomplished using another suitable means. For example, the means for transmitting the control or data signals may be a wireless transmitter, which may help reduce the need to provide separate data conductors in addition to the wand.

[00105] Upstream and/or downstream ends of wands 180 may include multi-conductor connectors that are mateable with corresponding multi-conductor connectors of surface cleaning head 108 and/or handle 160 respectively. In the illustrate example of FIGS. 9 and 19, upper portion 104 which is mounted to surface cleaning head 108 has a multi-conductor connector 1042, in which male push-type connectors for each of the respective conductors of wand 180 are provided. Multi-conductor connector 1042 is mateable with a multi-conductor connector 1038 of an upstream end of wand 180, which has female push-type connectors corresponding to the male connectors of multi-conductor connector 1042. It will be appreciated that the male-female relationship may be reversed, or connectors of other suitable types may be used. It will be appreciated that multi-conductor connector 1042 may be provided on surface cleaning head 108 or any other location on upper portion 104, such as an exterior surface thereof. Preferably, it is located internally of upper portion 104 such that an electrical connection is made when wand 180 is inserted into upper portion 104.

[00106] Similarly, a downstream end of wand 180 may be provided with a multi-conductor connector 3344, which is mateable with a multi-conductor connector 2046 of handle 180, as seen in FIGS. 16a and 16b.

[00107] Providing electrical conductors within the wand 180 may allow the wand to transmit electrical signals (power and/or control signals) between its upstream and downstream ends. Optionally, the conductors may be attached to the inner surface of the wand (i.e. within the air flow path), attached to the outer surface of the wand or incorporated within the sidewall of the wand 180. This may eliminate the need for a separate wire or other power transfer apparatus to be provided in addition to the wand and/or to run in parallel with the wand. Reducing the need for external power or control wires may reduce the chances that the exposed electrical wires may be damaged, unintentionally disconnected during use or otherwise compromised.

[00108] Providing electrical conductors within the wand 180 may allow the wand 180 to serve as a primary, and optionally only, electrical connection between the surface cleaning unit 112 and the surface cleaning head 108 (or any other portion of the vacuum cleaner that is connected to an external power supply) and the rest of the vacuum cleaner upstream from the wand. Optionally, in configurations in which the surface cleaning unit 112 is the only portion of the vacuum cleaner connected to the electrical

power cord which is plugged into the wall, the wand 180 may serve as the primary electrical conduit (e.g., in series with hose 124) for carrying power and/or control signals to the surface cleaning head 108, a plurality of cleaning tools, auxiliary tools, lights, sensors, power tools and other components that are connected to the upstream end of the wand 180 and used in combination with the surface cleaning unit. In an example embodiment, wand 180 is used to carry a power control signal used to energize surface cleaning unit 112.

[00109] Transmitting power via the wand 180 may also allow the wand to be used to supply power to cleaning tools and/or other power tools which may eliminate the need to provide a separate power connection for the tools or to require the use of batteries or an air turbine. For example, using an electrified wand to supply electrical power may allow the surface cleaning head 108 to be powered in a variety of different cleaning configurations, including those in which the surface cleaning unit 112 is removed from upper portion 104.

[00110] Referring now to FIGS. 1 and 19, the handle 160 and surface cleaning head 108 are provided with electrical connections via conductors and connectors. Providing electrical connections between the portions of the apparatus allows power to be transmitted from the surface cleaning unit 112 to the handle 160 and on to the surface cleaning head 108 (for example to power a rotating brush assembly) via the wand 180 and without the need for a separate electrical wire or connection. In other embodiments, it will be appreciated that hose 124 may be connected directly to wand 180 and the controls provided on either the hose 124 or wand 180.

[00111] In the example embodiment of FIGS. 19 and 20, a handle control circuit 3102 is provided in handle 160. Handle control circuit 3102 has three conductors connected via a multi-conductor connector to respective conductors of wand 180: a hot conductor 3510c, a neutral conductor 3520c and a brush control conductor 3552a. Wand 180 carries the hot, neutral and brush control conductors, each of which is connected using a multi-conductor connector to a respective conductor of the brush control circuit 3202.

[00112] Handle control circuit has a handle control processor 3110, which is coupled to brush control 3020. Based on the selected position of brush control 3020, handle control processor 3110 is configured to transmit a brush control signal via brush

control conductor 3552a. The signal is relayed via the control conductor of wand 180 to brush control conductor 3552b of brush control circuit 3202. Brush control circuit 3202 has a brush control processor 3210, which receives the brush control signal, and is configured to modulate a motor speed of brush motor 3094 accordingly.

[00113] Each of handle control processor 3110 and brush control processor 3210 may be a suitable microprocessor or microcontroller. In one example embodiment, the processors are 8-bit microcontrollers with a RISC-type instruction set.

POWER CONTROL CIRCUIT

[00114] Reference is made to FIGS. 19 and 20 illustrating a schematic diagram of a power control circuit 3002 for a surface cleaning apparatus that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed herein, including, for example, with one or more of the first, second, third and fourth aspects.

[00115] Power control circuit 3002 comprises a power connector 3040, a suction motor relay circuit and a suction motor 128. It will be appreciated that power control circuit 3002 may also comprise various other elements, such as resistors, capacitors, diodes, transistors, varistors and fuses, the description of which is omitted here to ease explanation and understanding.

[00116] Power connector 3040 may be a two- or three-prong power connector, connectable to a 120V or 240V alternating current (AC) power supply. Power connector connects to a line-level or hot conductor 3510 and a neutral conductor 3520.

[00117] Hot conductor 3510 may be electrically coupled to a first terminal of a power control switch. In the example embodiment, hot conductor 3510 is coupled, via hose 124, to a first terminal of main power control 3014 of handle control circuit 3102, which is described in further detail herein. Both handle control circuit 3102 and main power control 3014 may be provided in handle 160, rather than in surface cleaning unit 112. A second terminal of main power control 3014 is tied to a power control conductor 3550a. Power control conductor 3550a is electrically coupled, via hose 124, to power control conductor 3550b.

[00118] Power control conductor 3550b is electrically coupled to suction motor relay circuit 3090. Suction motor relay circuit 3090 is configured such that when the

power control conductor 3550b is energized (e.g., when main power control 3014 is in the 'on' position), the relay circuit operates to close a relay, allowing suction motor 128 to become electrically coupled to hot conductor 3510, and thereby energized. Conversely, when main power control is 'off' (e.g., switch is open), suction motor relay circuit 3090 is configured to open the relay and thereby de-energize the suction motor 128.

[00119] The suction motor relay circuit 3090 allows the main power control 3014 to be disposed elsewhere on the surface cleaning apparatus, for example in handle 160, without requiring separate power and control wiring. It will be appreciated that power control circuit 3002 may also be adapted for a DC circuit, e.g., if the power supply is a battery or the like.

HANDLE CONTROL CIRCUIT

[00120] Reference is made to FIGS. 19 and 20 illustrating a schematic diagram of a handle control circuit 3102 for a surface cleaning apparatus that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed herein.

[00121] Handle control circuit 3102 includes hot conductors 3510 and 3510b, power control conductor 3550a, brush control conductor 3552a, neutral conductors 3520b and 3520c, main power control 3014, brush control 3020 and handle control processor 3110. Optionally, handle control circuit 3102 may include one or more indicator lights, whose operation is described with reference to FIG. 21. It will be appreciated that handle control circuit 3102 may also comprise various other elements, such as resistors, capacitors, diodes, transistors, TRIACs (triodes for alternating current) and fuses, the description of which is omitted here to ease explanation and understanding.

[00122] Hot conductor 3510 is electrically couplable to hot conductor 3510b via main power control 3014. When main power control 3014 is in the 'on' position, hot conductor 3510b conducts line-level power, via wand 180 (and multi-conductor connectors), to surface cleaning head 108.

[00123] In the example embodiment of FIG. 20, brush control 3020 is a multi-position switch. The switch is electrically connected, via jumpers to input/output pins of

handle control processor 3110. Handle control processor 3110 is configured to detect a selected position of the switch, based on the I/O pin signals, and to select a desired brush speed. Based on the selected position of the multi-position switch, the handle control processor 3110 can generate a brush control signal.

[00124] A brush control conductor 3552a is also electrically coupled to another I/O pin of brush control processor 3210. Accordingly, brush control processor 3210 can transmit the brush control signal via brush control conductor 3552a (and wand 180) to a brush control processor 3210 provided in surface cleaning head 108. Thereupon, the brush control processor 3210 is configured to select between at least two different brush power level outputs of the brush motor 128 based on the brush control signal.

[00125] It will be appreciated that handle control circuit 3102 may also be adapted for a DC circuit, e.g., if the power supply is a battery or the like.

BRUSH CONTROL CIRCUIT

[00126] Reference is made to FIGS. 19 and 20 illustrating a schematic diagram of a brush control circuit 3202 for a surface cleaning apparatus that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed herein, including, for example, with one or more of the first, second, third and fourth aspects.

[00127] Brush control circuit 3202 includes hot conductor 3510d, brush control conductor 3552b, neutral conductor 3520d, brush control processor 3210, bridge rectifier 3280 and TRIAC 3290. Optionally, brush control circuit 3202 may include one or more LEDs 3024 and other indicator lights (e.g., a brush indicator light 3086 as shown in FIG. 19), under the control of brush control processor 3210 as described with reference to FIG. 20. It will be appreciated that brush control circuit 3202 may also comprise various other elements, such as resistors, capacitors, diodes, transistors and fuses, the description of which is omitted here to ease explanation and understanding.

[00128] Hot conductor 3510d is electrically coupled to TRIAC 3290, which is coupled to bridge rectifier 3280.

[00129] Both brush control conductor 3552b and hot conductor 3510d are electrically coupled to an I/O pin of brush control processor 3210. The input of the I/O pin can be modulated by a brush control signal provided by handle control processor

3110. Brush control processor 3210 detects the input and determines an appropriate brush power level output for brush motor 3094.

[00130] The desired brush power level output can be attained by using another I/O pin of brush control processor 3210 to control TRIAC 3290. For example, brush control processor 3210 may provide a small trigger pulse signal at a controlled phase angle to control the percentage of current that flows through TRIAC 3290 to bridge rectifier 3280. Bridge rectifier converts the incoming modulated current to DC, which allows brush motor 3094 to be powered accordingly. It will be appreciated that brush motor 3094 may be AC or DC powered and brush control circuit 3202 modified accordingly.

[00131] Optionally, brush control circuit 3202 may also include an upright switch 3350. In the example embodiment, upright switch 3350 may be coupled to yet another I/O pin of brush control processor 3210, which may detect the state of the upright switch 3350. Upright switch 3350 may also be mechanically coupled to surface cleaning head 108 and upper portion 104, such that the switch is engaged in the 'on' position when the upper portion 104 is inclined relative to the vertical, and disengaged in the 'off' position when the upper portion 104 is returned to the vertical.

[00132] It will be appreciated that brush control circuit 3202 may also be adapted for a DC circuit, e.g., if the power supply is a battery or the like.

INDICATOR LIGHT LOGIC

[00133] The following is a description of an indicator light circuit logic that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed herein, including, for example, with one or more of the first, second, third and fourth aspects.

[00134] Reference is made to FIG. 21, which illustrates a logic flow diagram for operating various indicator lights of surface cleaning apparatus 100. In the example embodiment illustrated, the logic flow is for controlling brush indicator light 3086 and headlight LEDs 3024 of surface cleaning head 108, handle light 3006 and brush selection indicators 3010a, 3010b and 3010c (FIG. 15).

[00135] The logic flow may be executed by any suitable processor. In the illustrated example, the logic flow is executed by handle control processor 3110 and brush control processor 3210 in co-operation. For ease of exposition, only one

processor will be referred to herein, however it will be appreciated that various acts of the logic flow may be performed by one or the other, or both, of handle control processor 3110 and brush control processor 3210.

[00136] Logic flow 3600 begins at 3602. At 3606, the processor determines, based on one or more switches, or based on a state of the circuits formed by conductors within hose 124, whether hose 124 is in a 'home' position (e.g., whether the hose 124 and handle 160 are attached to wand 180).

[00137] If it is determined at 3606 that the hose 124 is not in a 'home' position, handle light 3006 may be enabled at 3610, to provide illumination for the user while using the handle 160, and also to provide a visual indication that the handle 160 is not in complete engagement with wand 180.

[00138] If it is determined at 3606 that the hose 124 is in the 'home' position, handle light 3006 may be disabled, and LEDs 3024 of surface cleaning head 108 may be enabled at 3614. LEDs 3024 are arranged in a strip, and may act as headlights for the surface cleaning head, illuminating the surface to be cleaned.

[00139] At 3618, the processor determines a position of brush control 3020. If a 'thick carpet' mode is presently selected by brush control 3020, a 'thick carpet' indicator may be enabled at 3622 and brush indicator 3086 may also be enabled at 3626. Other indicator lights not corresponding to a currently-selected mode, such as the 'short carpet' or 'bare floor' indicators, may be disabled.

[00140] Brush indicator 3086 indicates that the brush motor is engaged, and that the brushes are rotating.

[00141] If instead, a 'short carpet' mode is presently selected by brush control 3020, the processor determines this at 3630, and enables a 'short carpet' indicator at 3634, along with brush indicator 3086 at 3638. Other indicator lights not corresponding to a currently-selected mode, such as the 'thick carpet' or 'bare floor' indicators, may be disabled.

[00142] If instead, a 'bare floor' mode is presently selected by brush control 3020, the processor determines this at 3642, and enables a 'bare floor' indicator at 3642. Brush indicator 3086 may be disabled, along with other indicator lights not

corresponding to a currently-selected mode, such as the 'thick carpet' or 'short carpet' indicators.

[00143] The processor or processors may continuously monitor the handle control circuit 3102 and brush control circuit 3202 for any changes in state, such as the user detaching the handle 160 from wand 180, or changing the selected mode via brush control 3020. When a change is detected, the logic flow may be repeated.

[00144] What has been described above has been intended to be illustrative of the invention and non-limiting and it will be understood by persons skilled in the art that other variants and modifications may be made without departing from the scope of the invention as defined in the claims appended hereto. The scope of the claims should not be limited by the preferred embodiments and examples, but should be given the broadest interpretation consistent with the description as a whole.

Claims:

1. A surface cleaning apparatus comprising:

a) a surface cleaning head comprising, a brush driven by a brush motor, a dirty air inlet and a cleaning head air outlet;

b) an upper portion moveably mounted to the surface cleaning head between a storage position and a floor cleaning position;

c) an air flow path extending from the cleaning head air outlet to a clean air outlet;

d) an air treatment member and a suction motor provided in the air flow path;

e) the air flow path comprising a flexible electrified air flow conduit wherein the brush motor is electrically connected to a power source by a circuit that includes the flexible electrified air flow conduit; and,

f) a handle assembly drivingly connected to the surface cleaning head and comprising a main power control and a brush control controllingly coupled to the brush motor.

2. The surface cleaning apparatus of claim 1 wherein the handle assembly comprises a handle useable by a hand of a user to direct the surface cleaning head and the brush control and the main power control are each operable by the hand while the user uses the hand to direct the surface cleaning head.

3. The surface cleaning apparatus of claim 1 wherein the handle assembly comprises a handle and the brush control and the main power control are each positioned proximate the handle.

4. The surface cleaning apparatus of claim 1 wherein the handle assembly comprises a handle and the brush control and the main power control are each positioned on the handle.

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5. The surface cleaning apparatus of claim 1 wherein the brush control is adjustable such that the brush motor is operable in at least two different modes.

6. The surface cleaning apparatus of claim 5 wherein the brush control comprises a multi-position switch.

7. The surface cleaning apparatus of claim 1 wherein the upper portion comprises a rigid airflow conduit removably connectable to the cleaning head air outlet, the airflow conduit comprising a conduit air inlet and a conduit air outlet, the conduit air inlet having an associated multi-conductor connector mateable with a multi-conductor connector of the surface cleaning head.

8. The surface cleaning apparatus of claim 1 wherein the brush control is a multi-position control, the circuit comprises a handle control processor coupled to the multi-position control and a brush control processor, wherein the handle control processor is configured to transmit a brush control signal via a control conductor to the brush control processor based on a selected position of the multi-position control, and wherein the brush control processor is configured to sequentially select between at least two different brush power level outputs of the brush motor based on the brush control signal.

9. The surface cleaning apparatus of claim 8 wherein the main power control is provided in series with the control conductor and a hot conductor.

10. The surface cleaning apparatus of claim 1 wherein the upper portion comprises a rigid airflow conduit having a lower end that is removably connectable in air flow communication and electrically connectable to the surface cleaning head, and the handle assembly is removably connectable in air flow communication and electrically connectable to an upper end of the rigid airflow conduit.

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11. The surface cleaning apparatus of claim 10 wherein the upper end of the rigid conduit is an outlet end and the flexible electrified air flow conduit is downstream of the upper end and is electrically connected to the rigid conduit via the handle assembly.

12. The surface cleaning apparatus of claim 1 further comprising a light source disposed on the handle assembly.

13. The surface cleaning apparatus of claim 12 wherein the light source is automatically powered when the handle assembly is electrically disconnected from the surface cleaning head.

14. The surface cleaning apparatus of claim 1 further comprising a surface cleaning unit removably mounted to the upper portion, the surface cleaning unit comprising the suction motor and the air treatment member.

15. A surface cleaning apparatus comprising:

a) a surface cleaning head comprising, a brush driven by a brush motor, a dirty air inlet and a cleaning head air outlet;

b) an upper portion moveably mounted to the surface cleaning head between a storage position and a floor cleaning position;

c) an air flow path extending from the cleaning head air outlet to a clean air outlet;

d) an air treatment member and a suction motor provided in the air flow path;

e) the air flow path comprising a flexible electrified air flow conduit wherein the brush motor is controllingly connected to a power source by a circuit that includes the flexible electrified air flow conduit; and,

f) a handle assembly drivingly connected to the surface cleaning head and a light source disposed on the handle assembly.

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16. The surface cleaning apparatus of claim 15 wherein the light source is automatically powered when the handle assembly is electrically disconnected from the surface cleaning head.

17. The surface cleaning apparatus of claim 15 further comprising at least one of a main power control and a brush control controllingly coupled to the brush motor positioned proximate the handle assembly.

18. The surface cleaning apparatus of claim 17 wherein the handle assembly comprises a handle useable by a hand of a user to direct the surface cleaning head and the at least one of the brush control and the main power control are operable by the hand while the user uses the hand to direct the surface cleaning head.

19. The surface cleaning apparatus of claim 17 wherein the handle assembly comprises a handle and the at least one of the brush control and the main power control are positioned proximate the handle.

20. The surface cleaning apparatus of claim 17 wherein the handle assembly comprises a handle and the at least one of the brush control and the main power control are positioned on the handle.

21. The surface cleaning apparatus of claim 15 wherein the upper portion comprises a rigid airflow conduit having a lower end that is removably connectable in air flow communication and electrically connectable to the surface cleaning head, and the handle assembly is removably connectable in air flow communication and electrically connectable to an upper end of the rigid airflow conduit.

22. The surface cleaning apparatus of claim 15 further comprising a surface cleaning unit removably mounted to the upper portion, the surface cleaning unit comprising the suction motor and the air treatment member.

Date Reçue/Date Received 2022-08-22

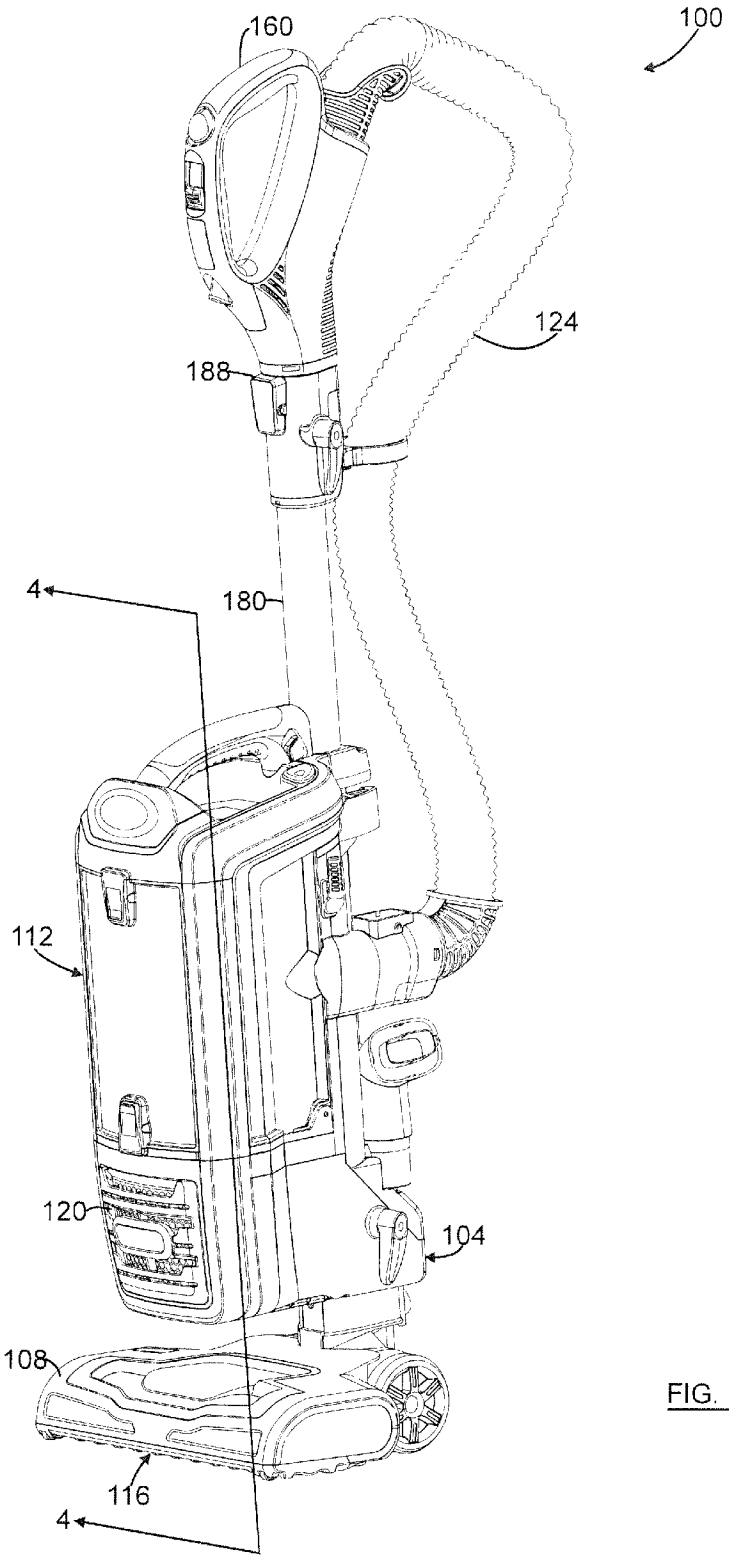


FIG. 1

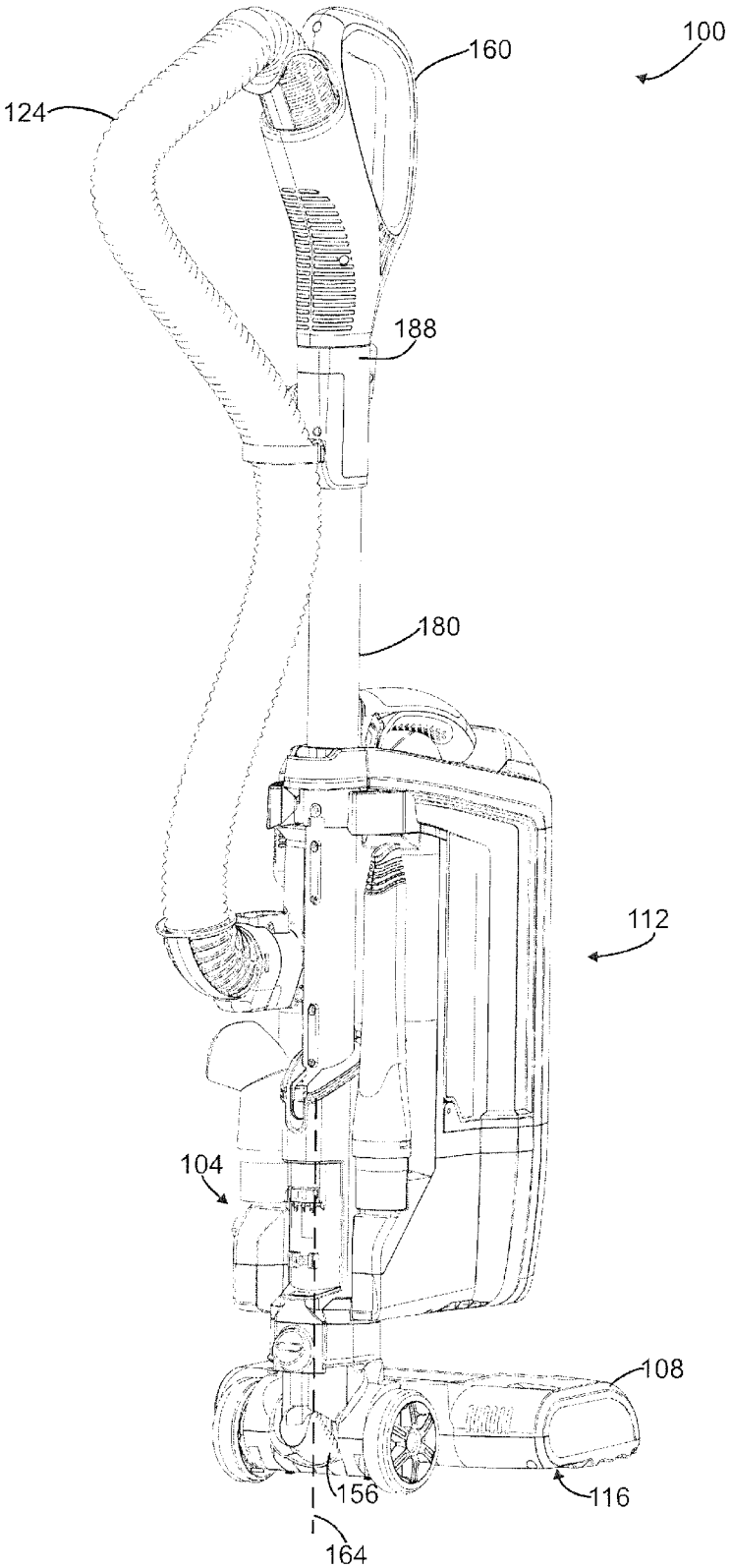


FIG. 2

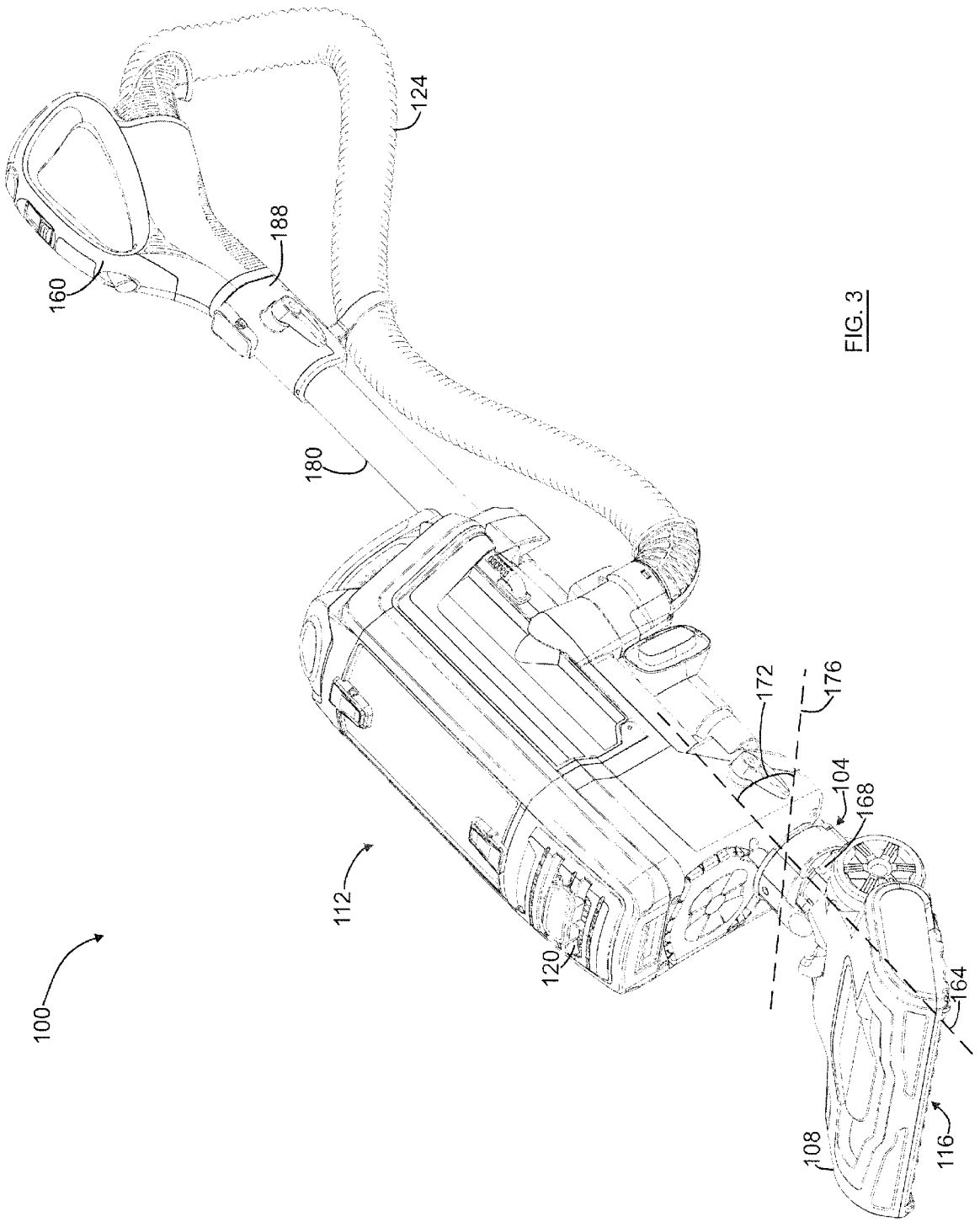


FIG. 3

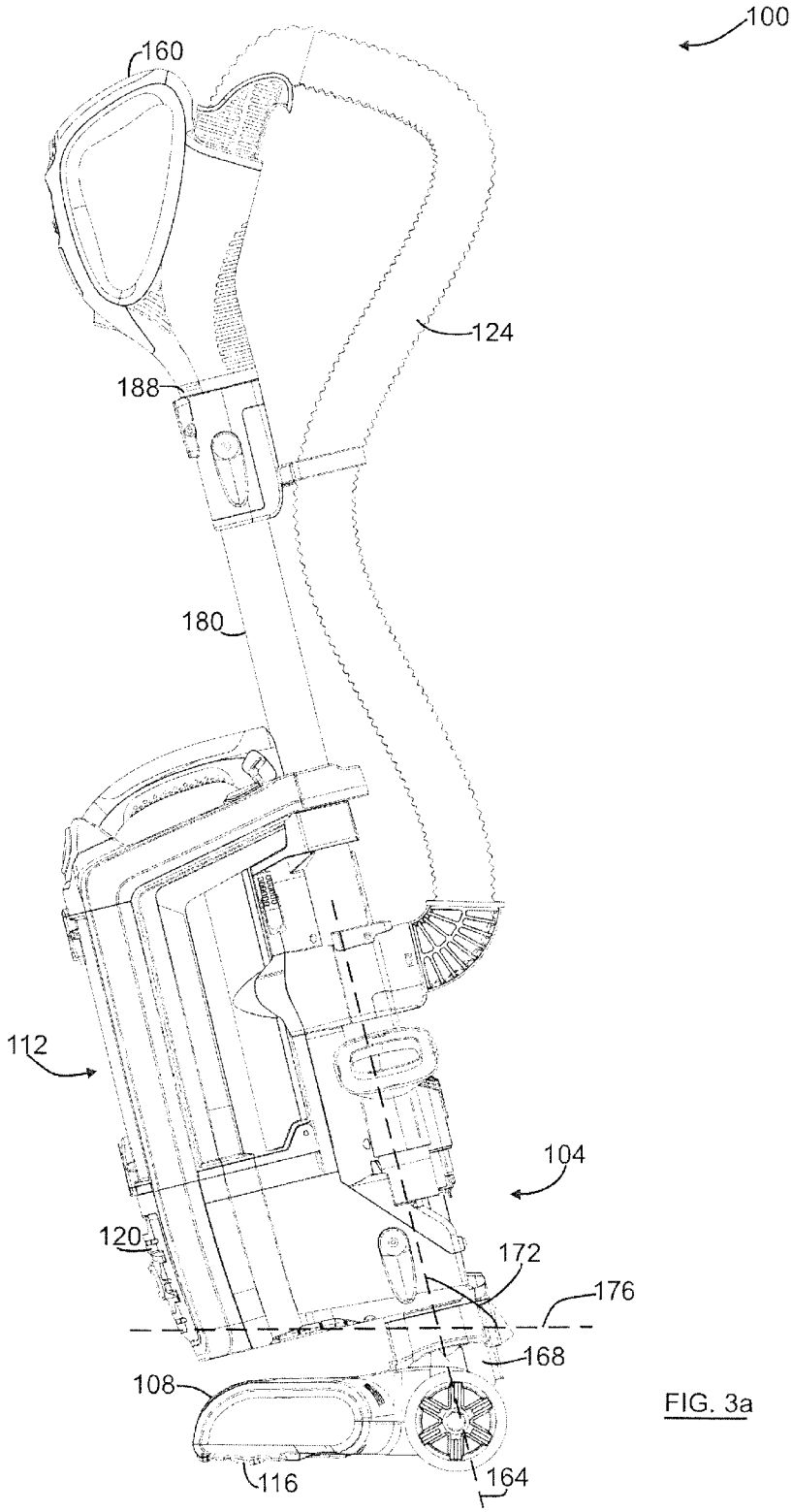


FIG. 3a

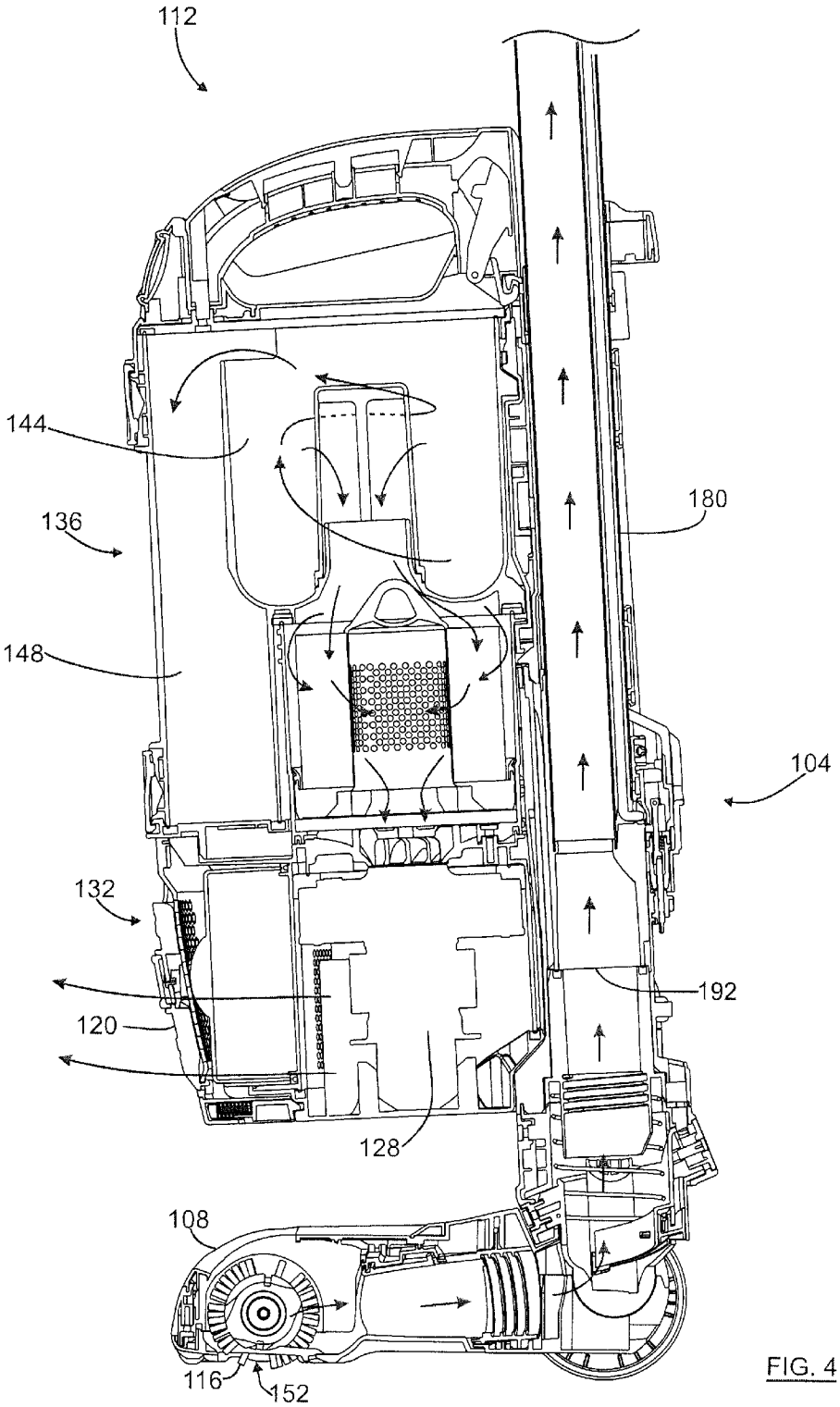


FIG. 4

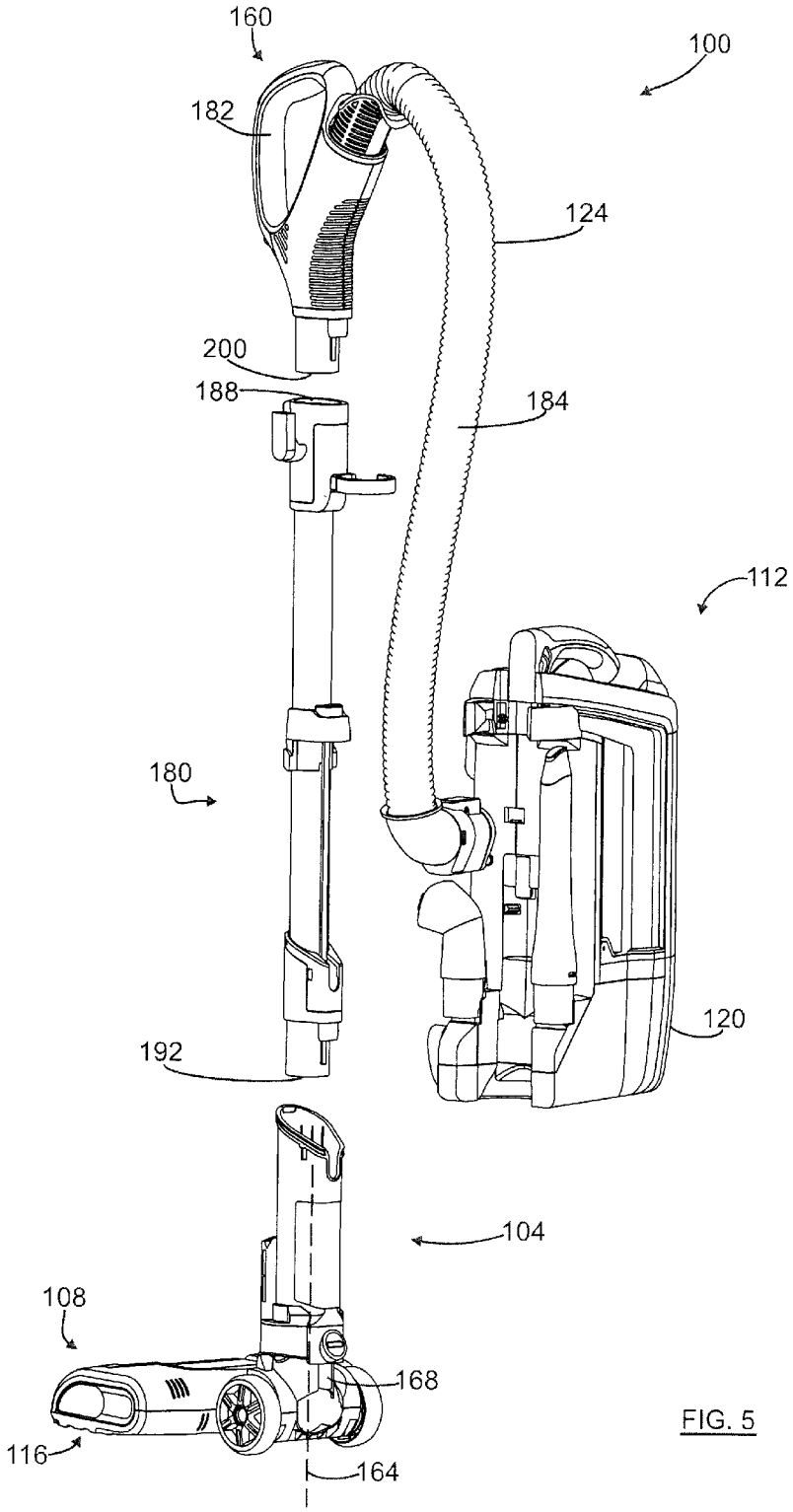


FIG. 5

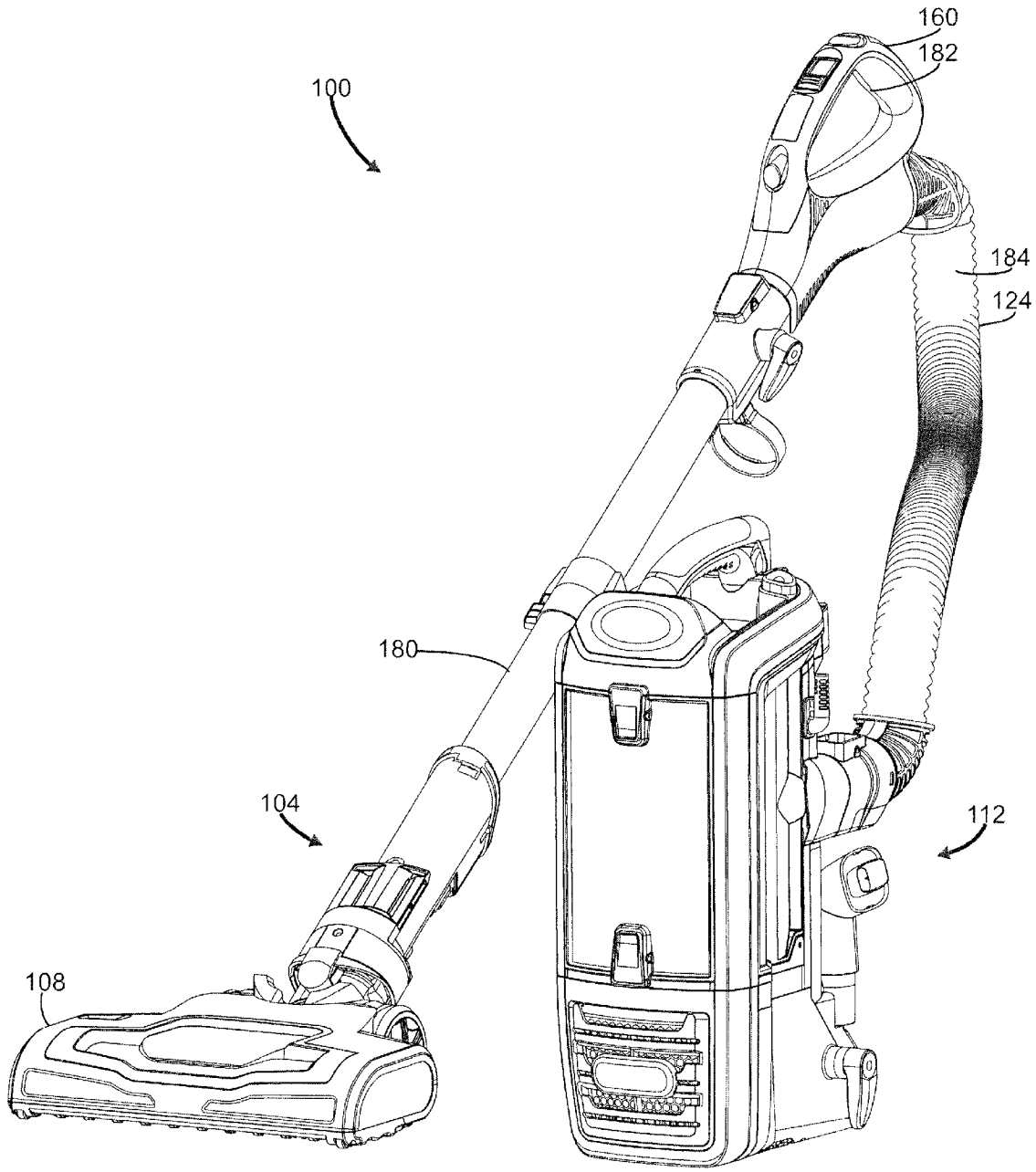


FIG. 6

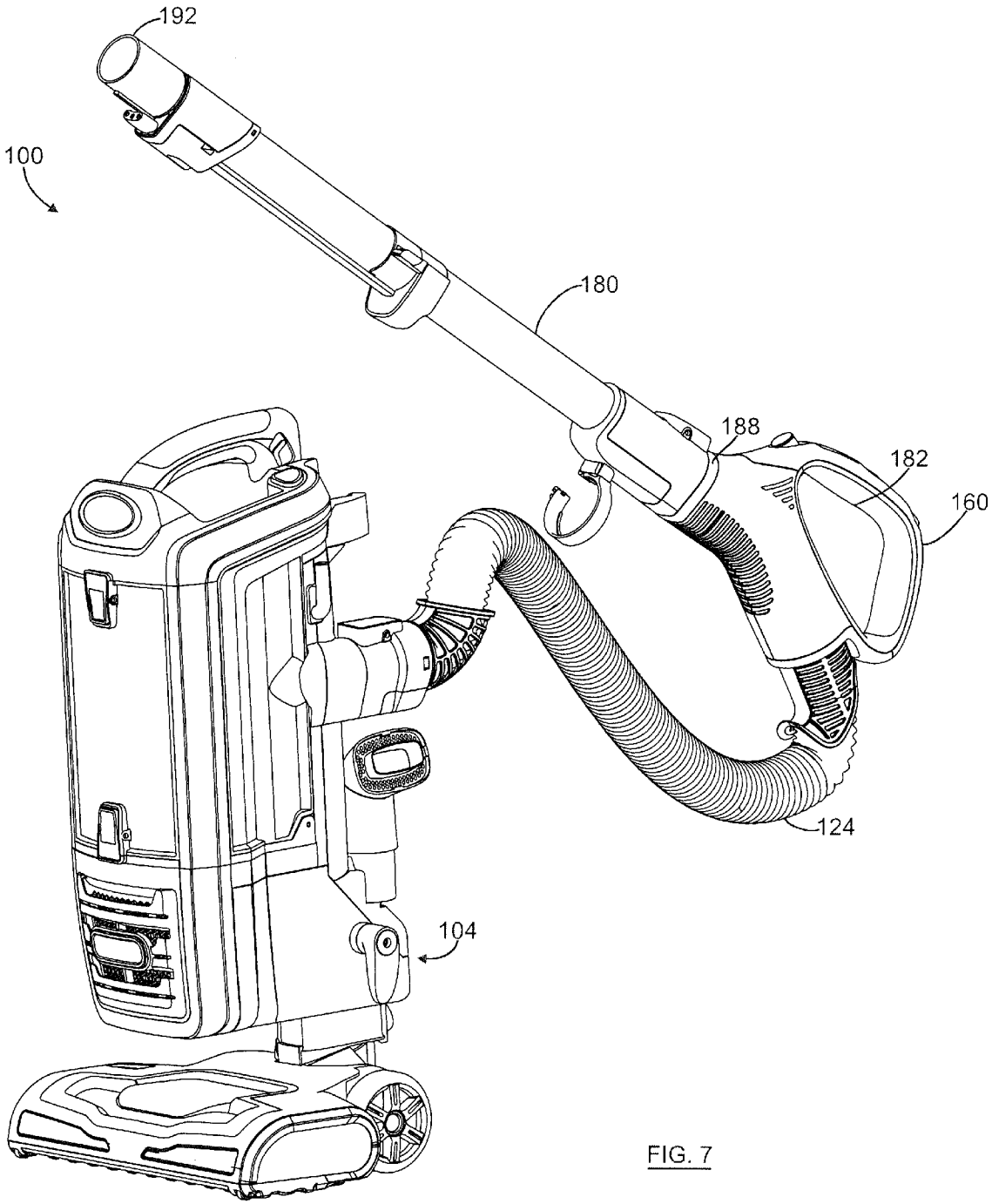


FIG. 7

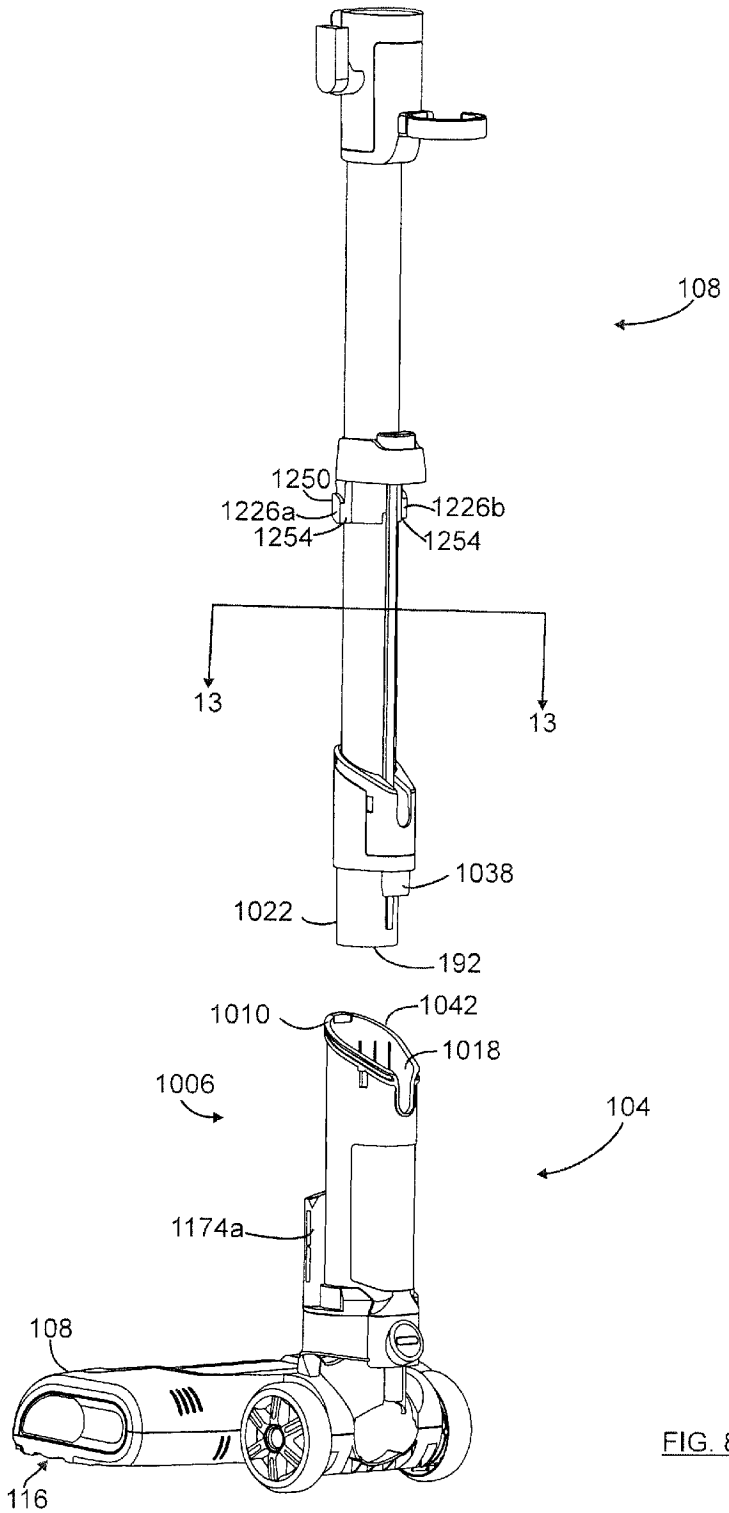
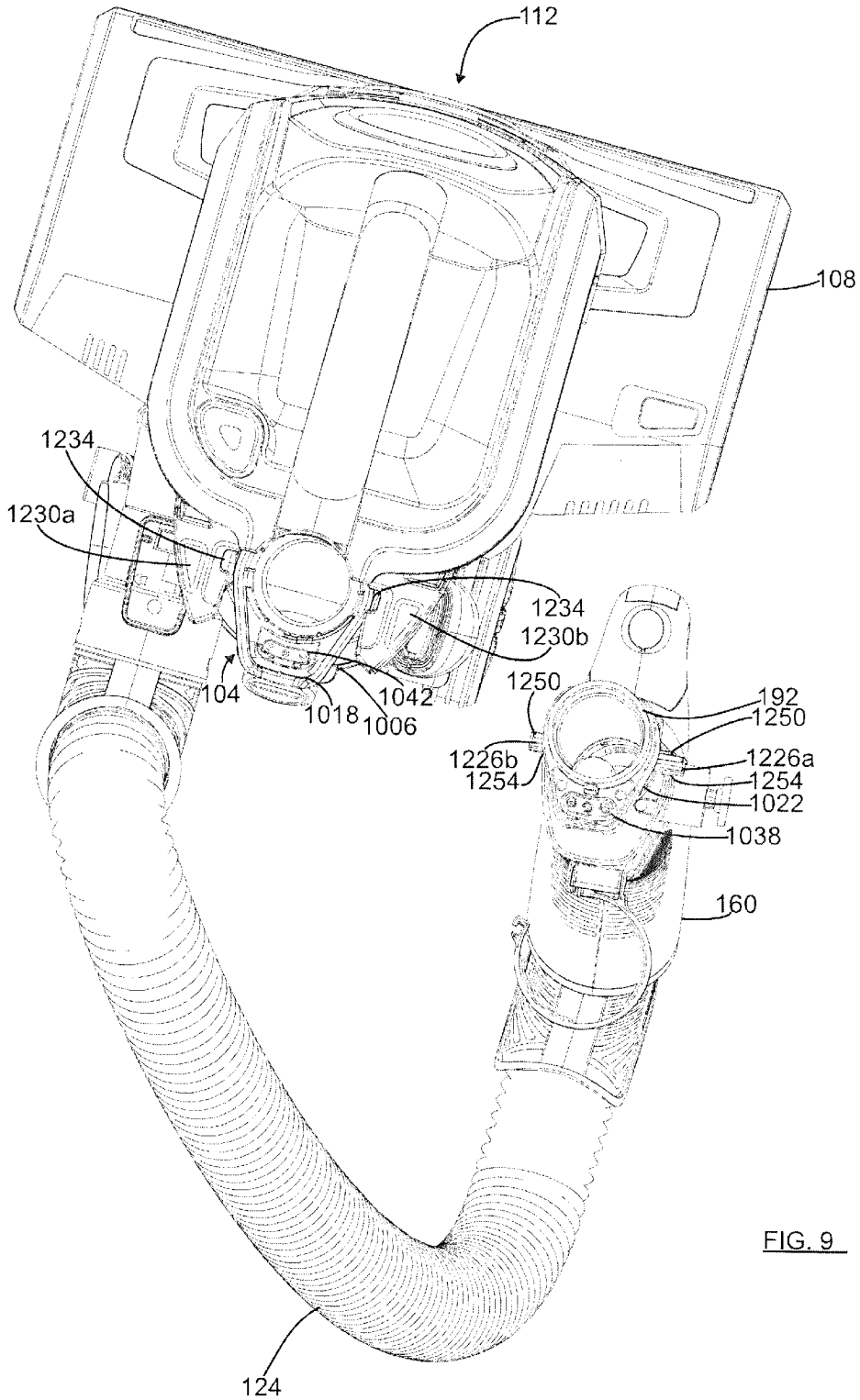

108
1250
1226a
1254
1226b
1254
13
13
1038
1022
192
1010
1042
1018
1006
104
1174a
108
116

FIG. 8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108
1234
1230a
1234
1230b
104
1042
1018
1006
1250
192
1250
1226b
1254
1226a
1254
1022
1038
160
124

FIG. 9

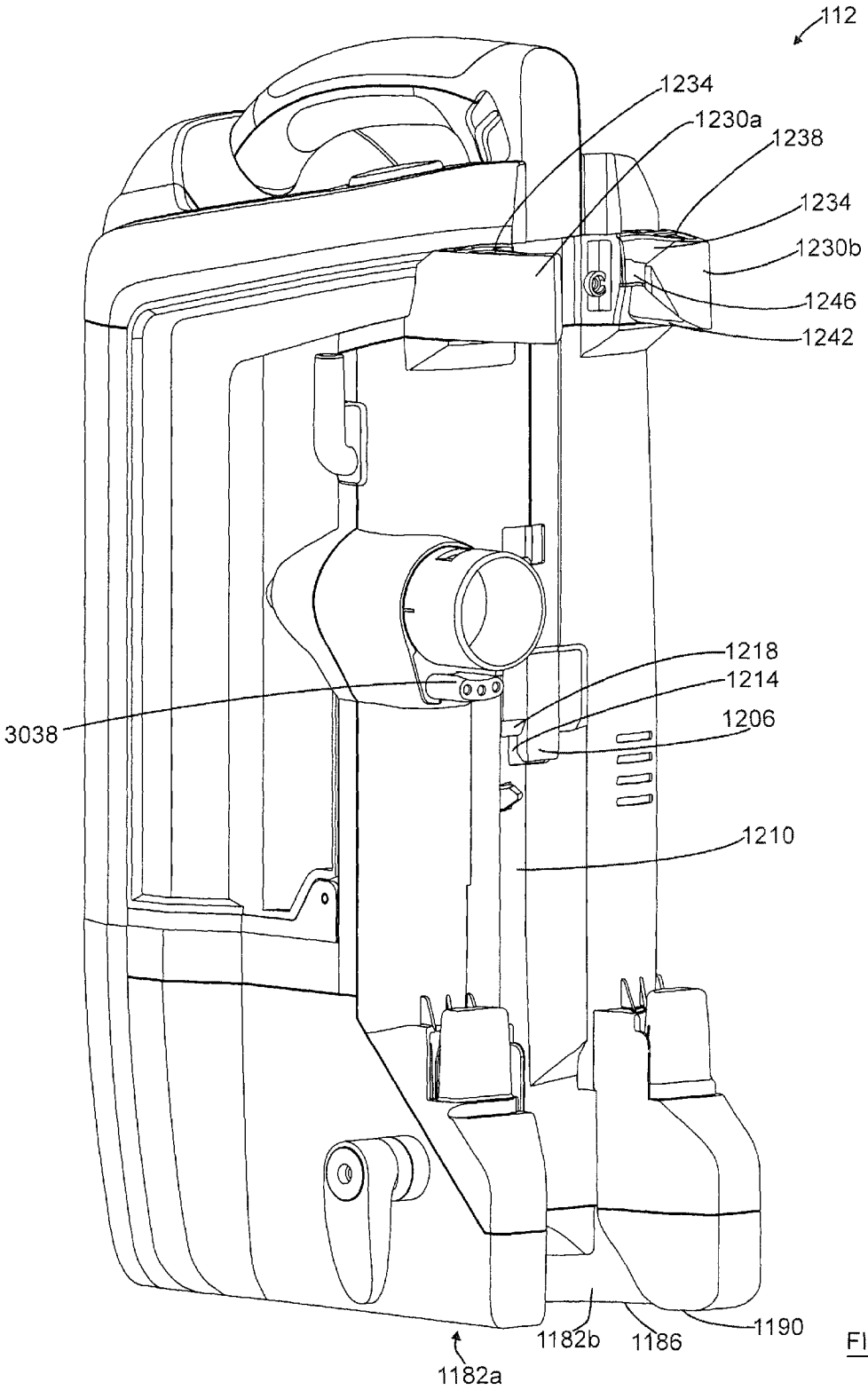

112
1234
1230a
1238
1234
1230b
1246
1242
1218
1214
1206
3038
1210
1190
1182b
1186
1182a

FIG. 10

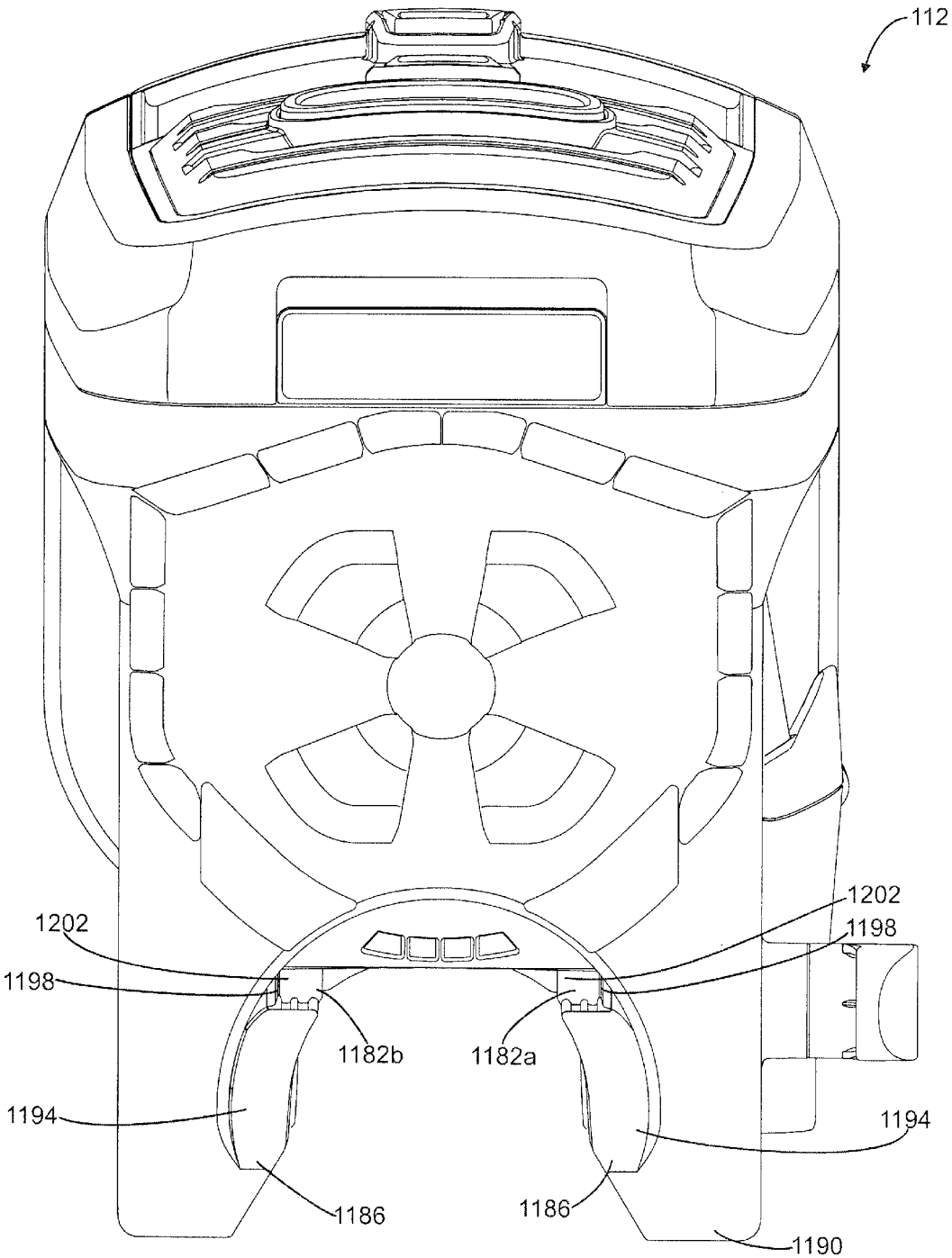


FIG. 11

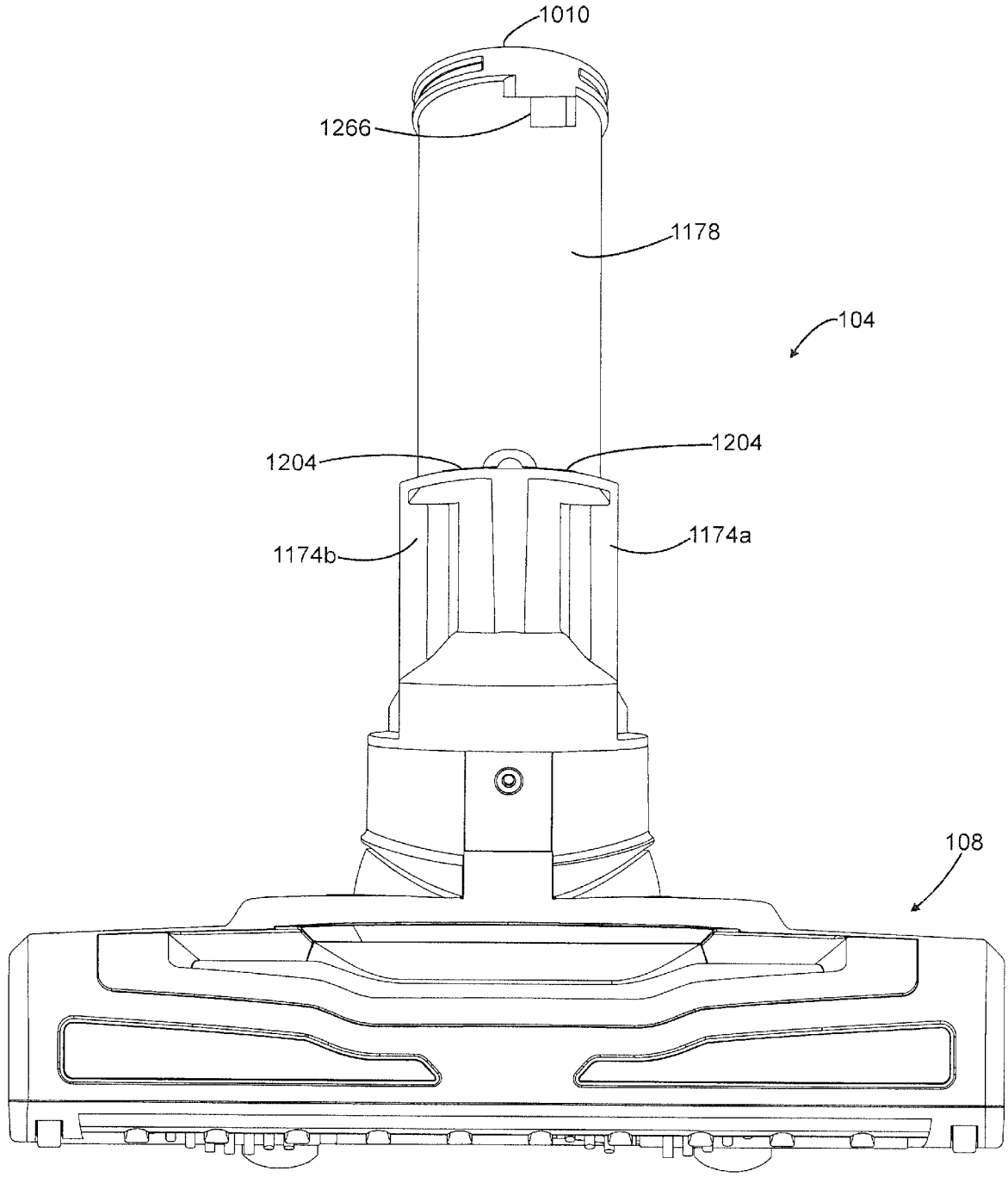


FIG. 12

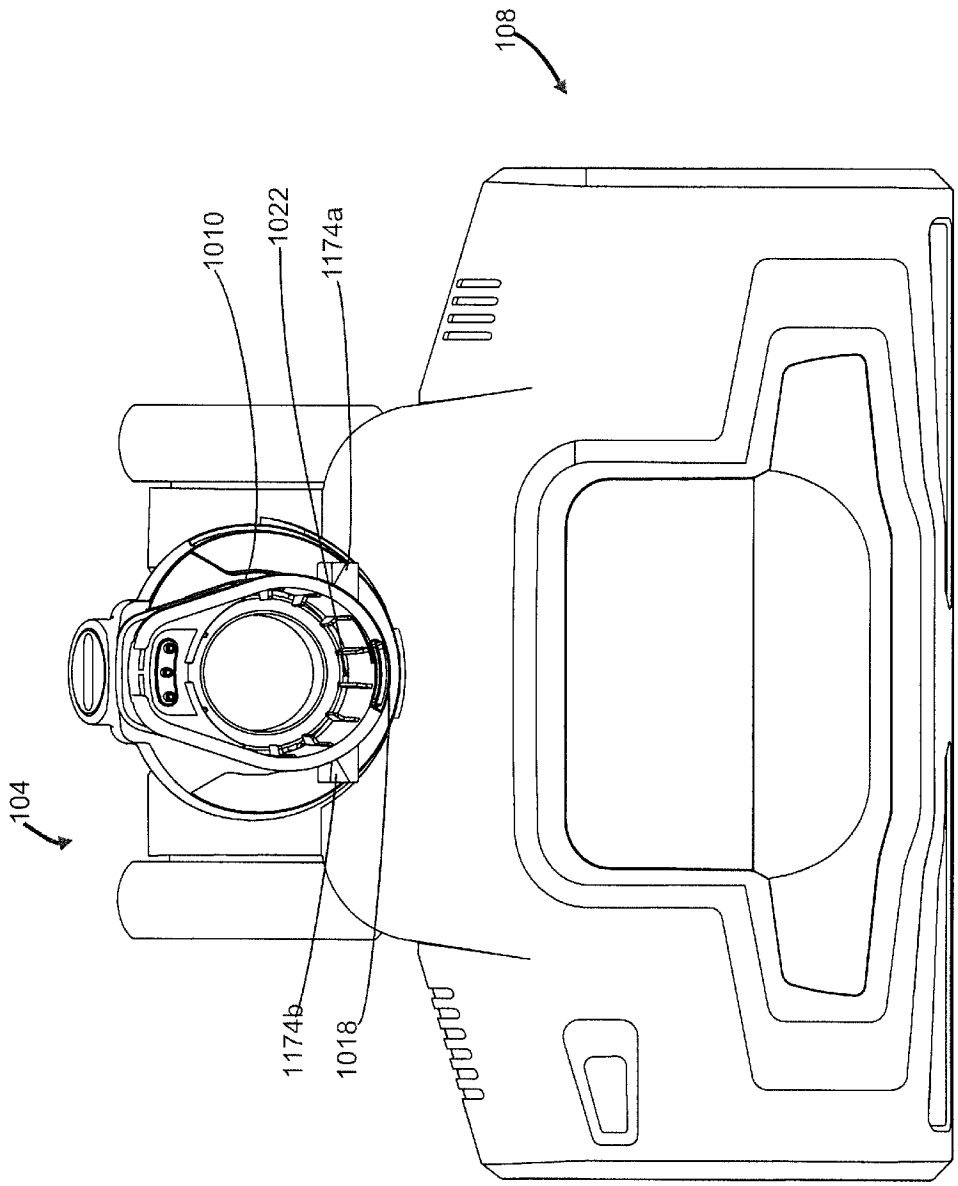


FIG. 13

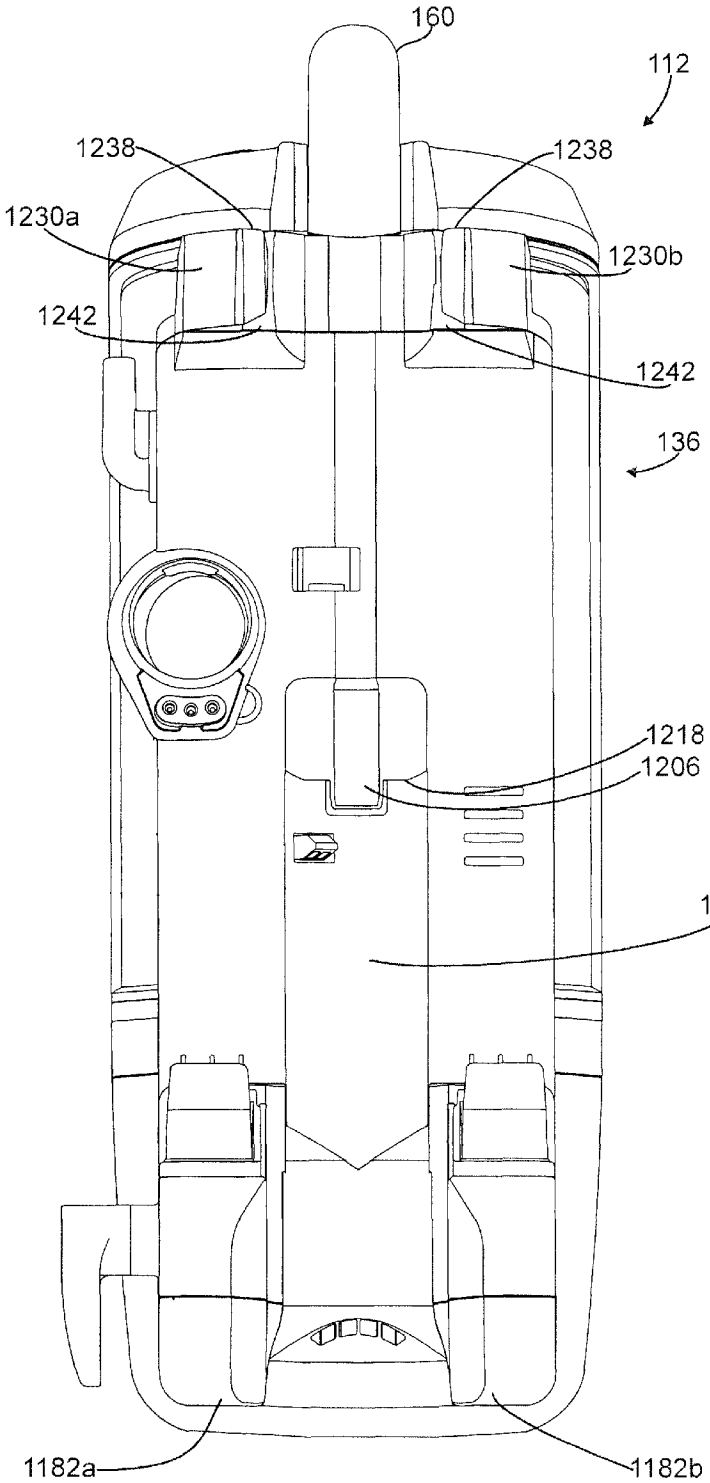

160
112
1238
1238
1230a
1230b
1242
1242
136
1218
1206
1210
1182a
1182b

FIG. 14

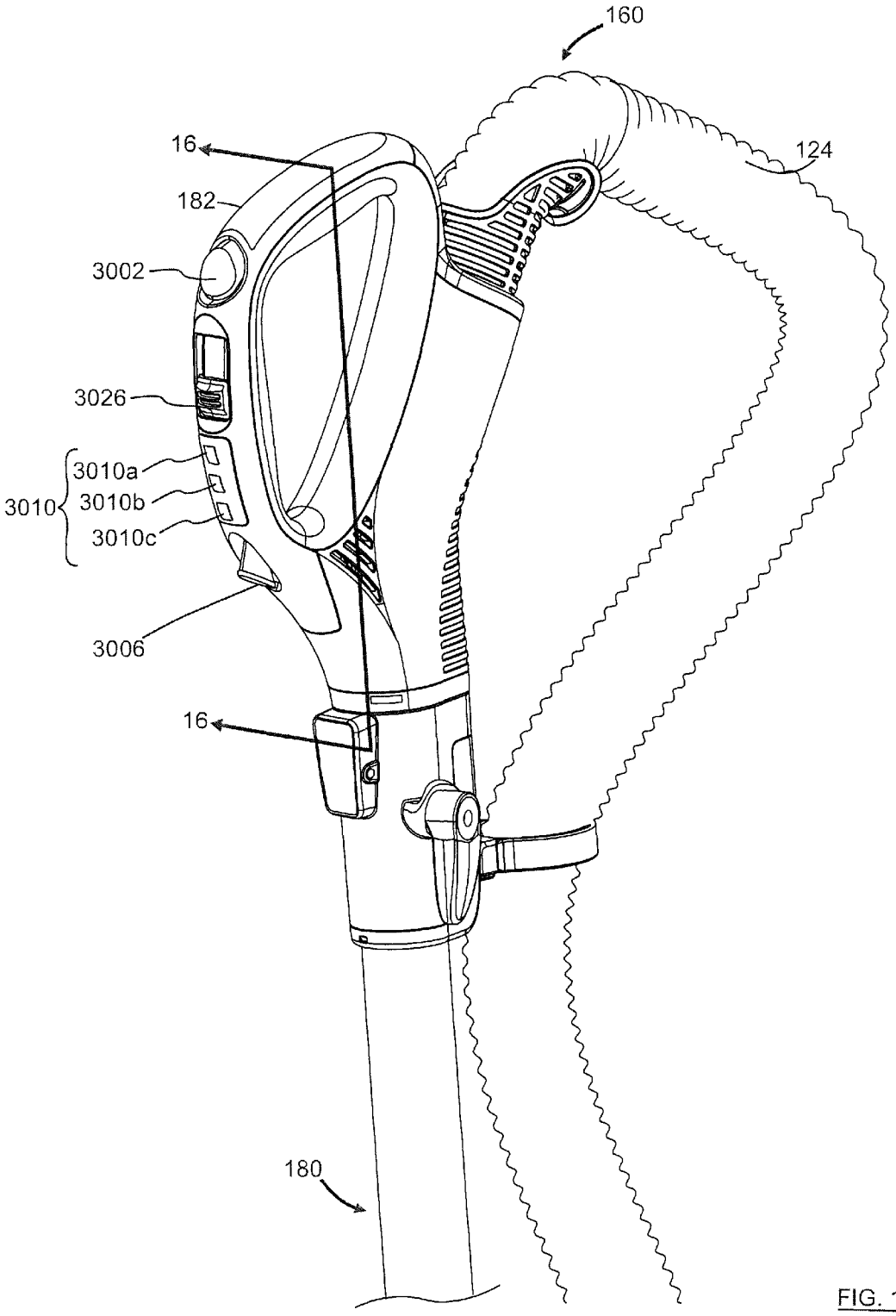


FIG. 15

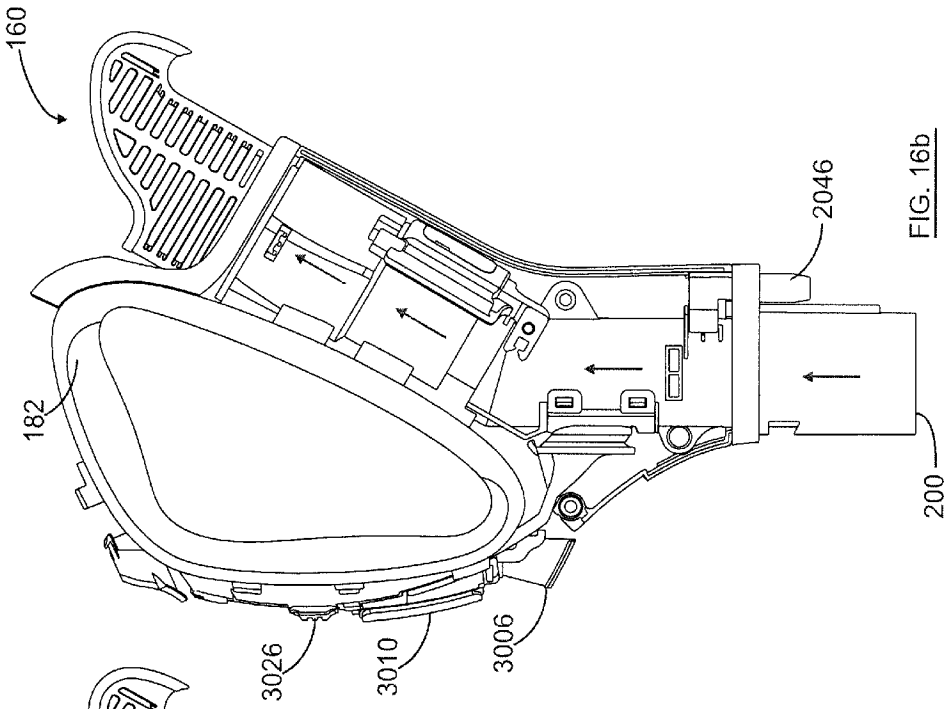


FIG. 16b

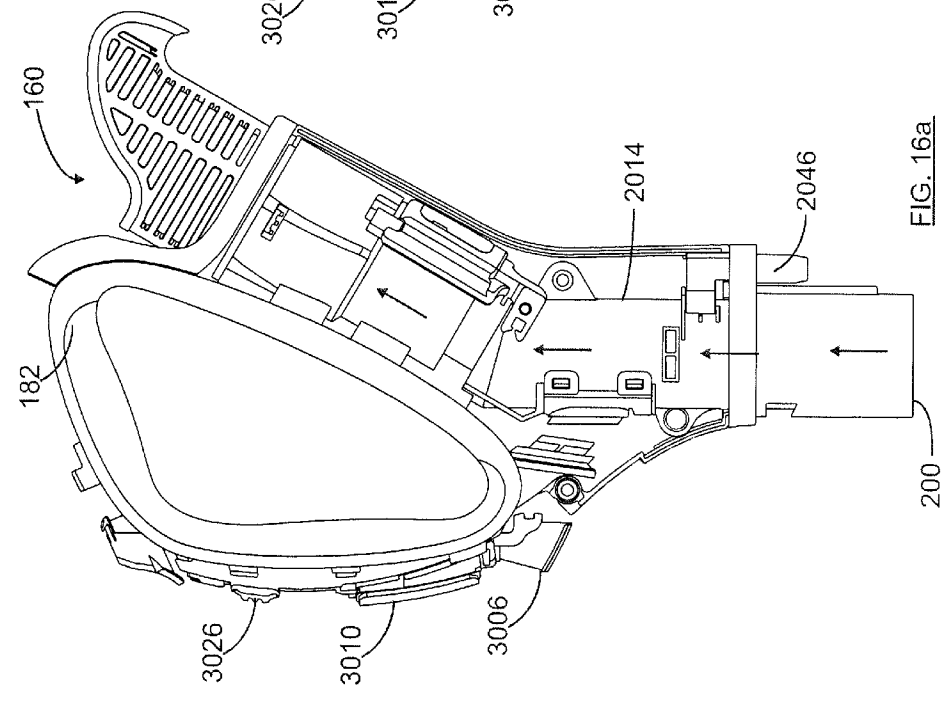
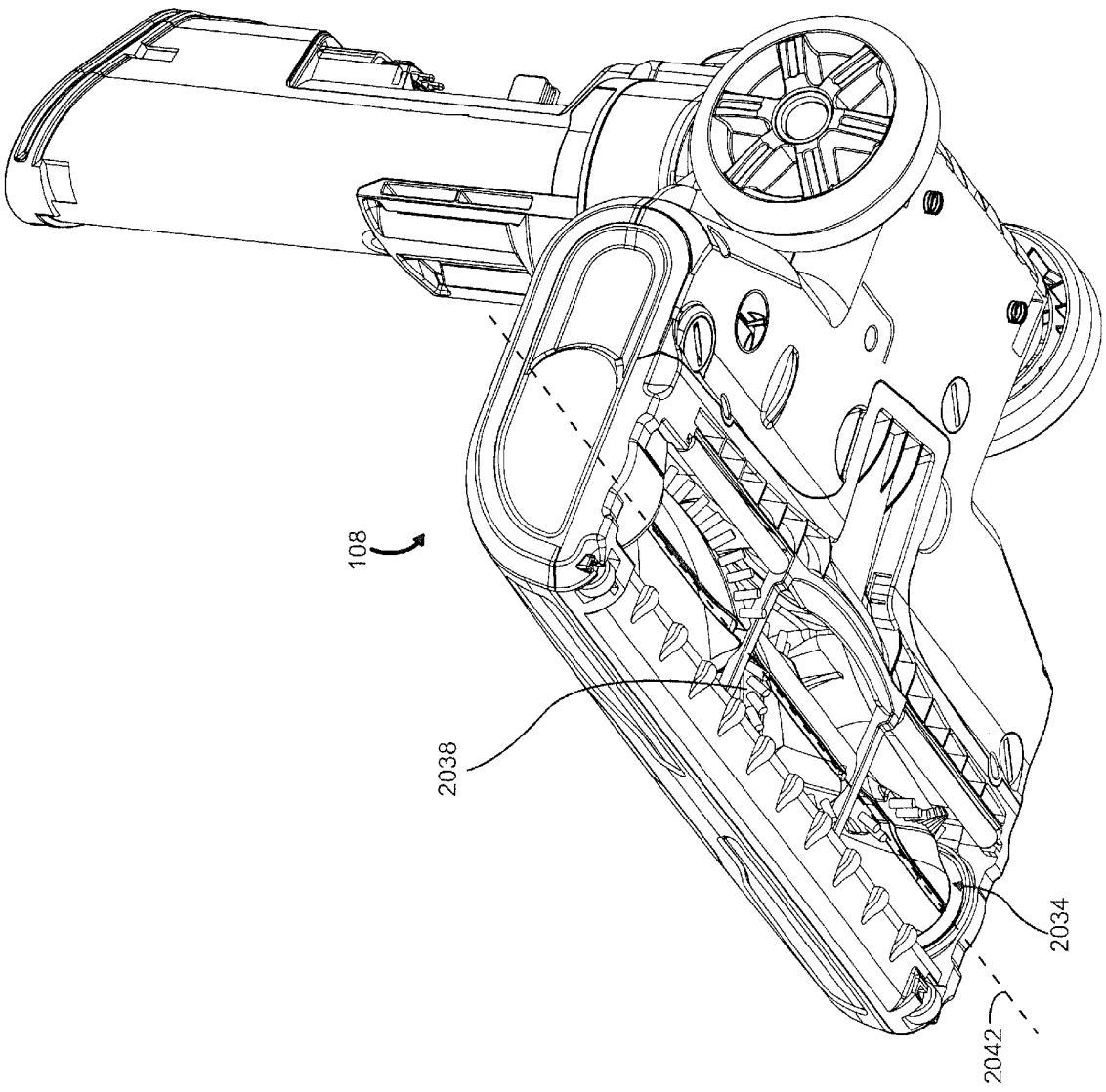


FIG. 16a

FIG. 17



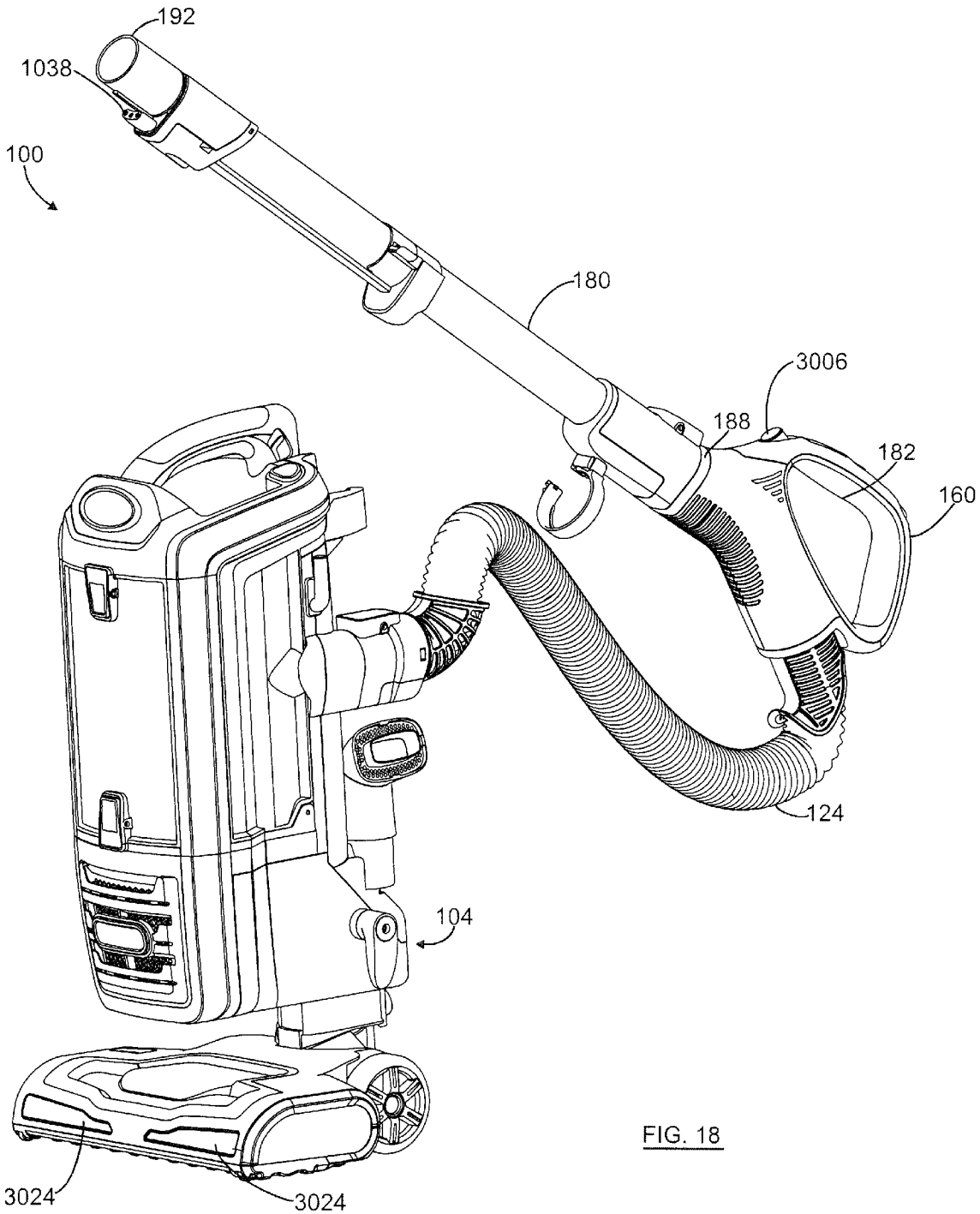
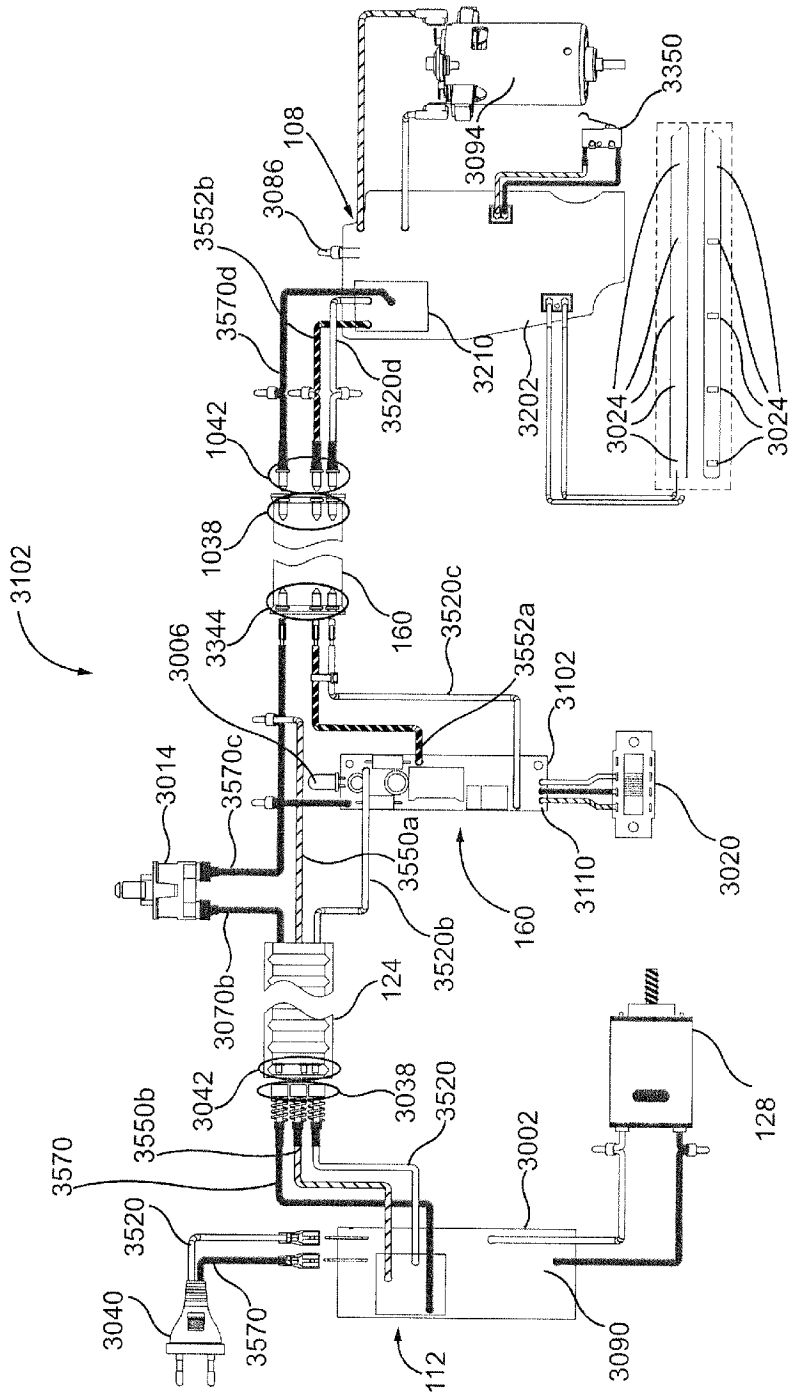


FIG. 18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1038
1042
3086
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3570d
3520d
3210
3202
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3350
3024
3024
160
3520c
3552a
3102
3014
3570c
3550a
3520b
160
3110
3020
3070b
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3520
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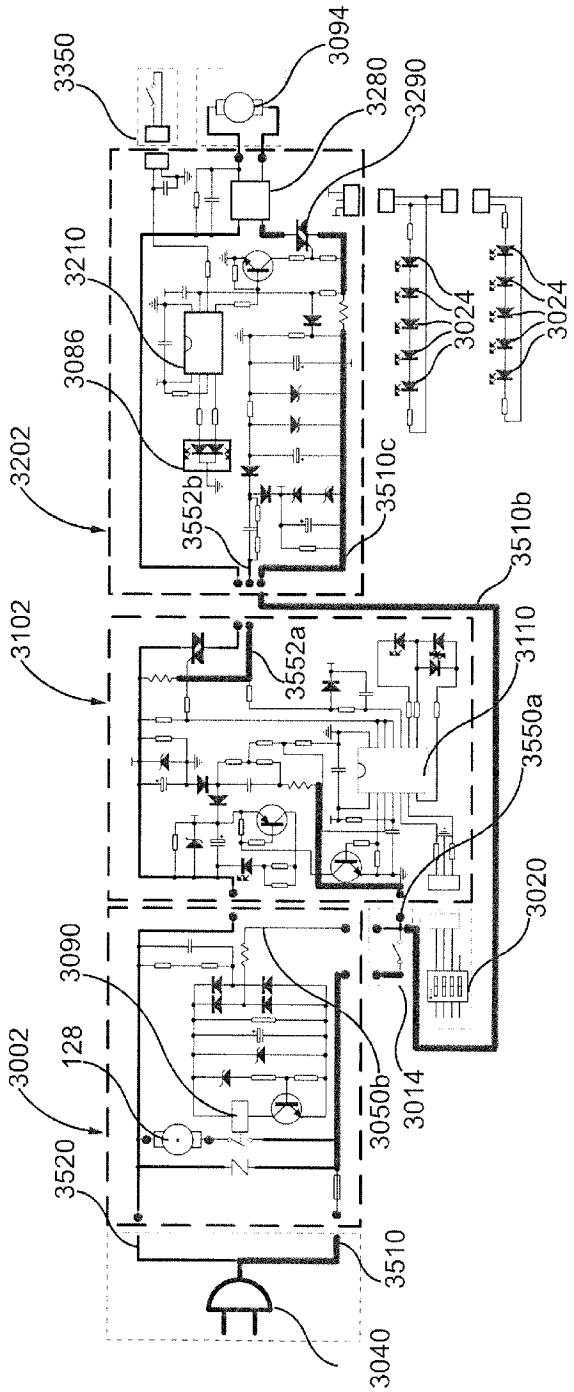
3570
3520
3040
3570
112
3002
3090
128

FIG. 19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3290
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3024
3202
3552b
3510c
3510b
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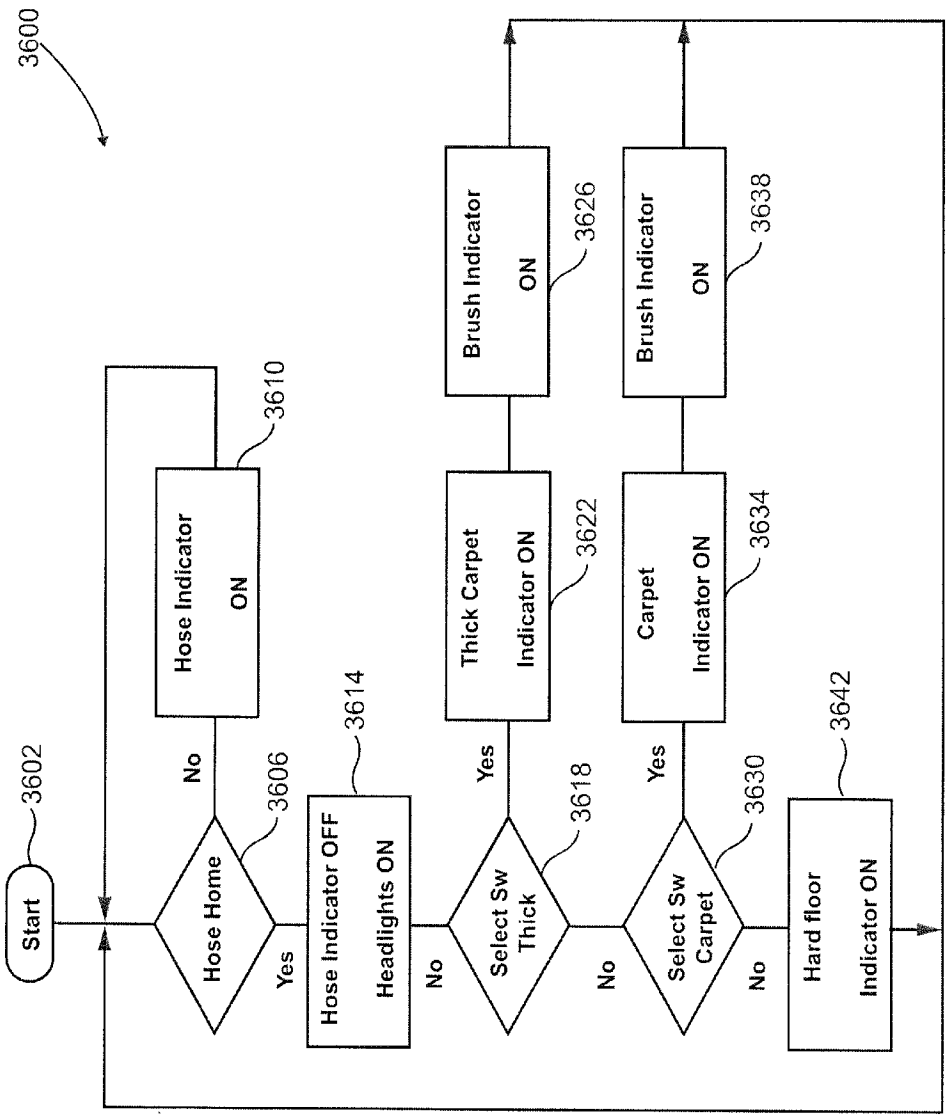
3110
3550a
3020
3090
3002
128
3050b
3014
3520
3510
3040

FIG. 20


3600
Start
3602
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3606
No
Yes
Hose Indicator ON
3610
Hose Indicator OFF
Headlights ON
3614
No
Select Sw Thick
3618
Yes
No
Thick Carpet Indicator ON
3622
Brush Indicator ON
3626
Select Sw Carpet
3630
Yes
No
Carpet Indicator ON
3634
Brush Indicator ON
3638
Hard floor Indicator ON
3642

FIG. 21